U.S. Infantry School Fort Benning, Ga.

The Infantry School
MAILING LIST

A compilation of instructional matter
prepared at The Infantry School
and
published biannually

Containing the Latest Thought on Infantry

VOLUME XXIX

Prepared by the
Academic Department of the Infantry School
by direction of Major General
John W. O'Daniel, Commandant,
and
under the supervision of
Brigadier General W. P. Shepard,
Assistant Commandant

DISTRIBUTED BY THE BOOK DEPARTMENT
THE INFANTRY SCHOOL, FORT BENNING, GEORGIA

13563 FT. BENNING, GA. 15 JULY 46 10,000

RESTRICTED. For sale to military personnel only.
Not to be reproduced.

356.07
Un3

PREFACE

This volume of The Infantry School Mailing List contains material contributed by the following officers:

Colonel Waine Archer, Infantry
Colonel Henry E. Kelly, Infantry
Lt. Colonel Greg J. Brown, Infantry
Lt. Colonel Charles U. Knaub, Infantry
Lt. Colonel Alan M. Strock, Infantry
Lt. Colonel Welborn G. Dolvin, Infantry (Armored)
Lt. Colonel Howard W. Greer, Infantry
Lt. Colonel Kenneth E. Robertson, Infantry
Lt. Colonel Mabry G. Miller, Infantry
Major William B. Sullivan, Infantry
Major Danial A. Raymond, Corps of Engineers
Captain Jesse C. Ugalde, Infantry
Captain Page H. Brownfield, Infantry
Captain James H. Craze, Infantry
Captain Edward J. Gorecki, Infantry
Captain Howard C. Nelson, Infantry
First Lieutenant Joseph A. Radcliff, Infantry

Major William D. McDowell, Infantry, edited this volume under the direction of Colonel Charles E. Beauchamp, Infantry, and Colonel Bernard A. Byrne, Infantry.

Original art work for this volume was prepared by Sergeant Dale C. Foster, Corporal James A. Thompson, Corporal Harold Clay, Private First Class Robert D. Wert, Private First Class Robert F. Vorreyer and Private Francisco G. Abascal.

The printing and binding was accomplished by the enlisted personnel of the Army Field Printing Plant, Fort Benning, Georgia, under the direction of Lieutenant Colonel Odi Casali, Infantry.

W. P. Shepard

W. P. SHEPARD
Brigadier General, U. S. Army
Assistant Commandant
The Infantry School

1172238

TABLE OF CONTENTS

October 1946

Chapter		*Page*
1.	Mechanical Training 57-mm Recoilless Rifle	1
2.	Mechanical Training 75-mm Recoilless Rifle	35
3.	Sound Locating Set GR-6	67
4.	Terrain Model DeLuxe	81
5.	Engineer Combat Battalion (Infantry Division)	111
6.	Tank Principles Don't Change	125
7.	"Powerhouse I"	135
8.	Infantry Radio Communication	145
9.	Gun Platoon in the Attack	159
10.	Athletics in the Physical Training Program	175
11.	A Formula for Instruction	193
12.	Preparation and Conduct of a Field Exercise	207
13.	Squad Management	237
14.	Extension Course of The Infantry School	249
15.	Combat S-4	267
16.	An Equal and Opposite Reaction	275
17.	Subcaliber Tactical Training	281
18.	Supply of the Rifle Company and the Battalion in the Defense	299

CHAPTER 1

Mechanical Training
57-mm Recoilless Rifle

T15E13

Section I. Description
Section II. Disassembly and Assembly
Section III. Mechanical Functioning
Section IV. Stoppages and Immediate Action
Section V. Care and Cleaning
Section VI. Ammunition and Fuses
Section VII. Bore Sight Adjustment

SECTION I

DESCRIPTION

1. PRINCIPLES OF OPERATION.—The 57-mm Recoilless Rifle T15E13 (Figure 1) is a single shot, air cooled, breech-loaded, flat-trajectory weapon, operating on the recoilless principle. Upon ignition of the propelling charge, equal and opposite reactions occur within the chamber. In the standard rifle, the expanding gases of the propellant create, upon firing, a pressure which forces the projectile forward through the tube, and at the same time, exerts a force to the rear against the face of the breechblock, or bolt, causing it to recoil. In the recoilless rifle this rearward force is neutralized by allowing gas to escape through openings in the breechblock. The shape of these openings is such that the gas rushing through them tends to exert a forward force on the rifle. The ballistics of the gun and the gas escape orifices are so designed as to produce equal

forward and rearward forces which nullify each other, causing no resultant rearward or forward motion. The openings are, in addition, so designed as to cause the gases escaping to the rear to exert a force equal and opposite to the torque induced by the projectile as it passes through the bore of the rifle, thus preventing the rifle from twisting or turning.

2. MOUNTING.—*a*. The 57-mm Recoilless Rifle is mounted on an integral bipod and monopod. The bipod consists of two legs which are equipped with shoulder padding and is fastened to the mounting bracket by means of a bipod retaining pin. The legs are mounted on a universal-type pivot and may be spread for prone firing. When the rifle is fired from the shoulder, or when in the traveling position, the legs are closed and positioned into the cradle mounting bracket, and locked in place.

b. Beneath the trigger group is a monopod which may be extended below its normal position about twelve inches for prone firing. The monopod is used as a handgrip for shoulder firing.

c. The rifle may be mounted on a machine-gun tripod (Model 1917) by inserting a cradle pintle in the cradle mounting bracket. The rifle may also be mounted on a pedestal mount or dash mount on a vehicle, or any other mount stationary or vehicular, which will accommodate the standard machine-gun cradle pintle.

3. GENERAL DATA.—*a*. The rifle consists essentially of a rifled tube, 57-mm in diameter, threaded at the rear to receive a large chamber. The breech is closed by a special type breechblock, with longitudinal openings which control the escape of gas. The openings are called orifices. The breechblock rotates to lock and unlock. This movement is accomplished with the aid of a breechblock handle, and is steadied by a chamber handle. When unlocked, the breechblock swings to the rear on the breechblock carrier. The piece is cocked as the breechblock is rotated counterclockwise. This action takes place at the same time as unlocking.

FIGURE 1.—57-mm Recoilless Rifle on Integral Mount.

FIGURE 2.—Bipod.

FIGURE 3.—57-mm Rifle on Pedestal Mount.

b. The mechanism required to fire the rifle is contained in the breechblock carrier assembly, the firing linkage, and the trigger group. The essential parts are the trigger, the grip safety, and the safety lock. There are two positions on the safety lock housing, indicated by the markings "S" and "F" (Safe and Fire). When the lever is rotated to the "Fire" position, the firing mechanism may be actuated.

FIGURE 4.—Open Breech with Round in Chamber.

c. Statistics (For T15E9, T15E13, and M-18).

Wt. gun w/o sights complete for mounting on tripod	lbs.	40.25
Wt. gun w/sights	lbs.	44.4
Wt. tripod and cradle	lbs.	53.0
Muzzle Velocity	ft./sec.	1200
Maximum Range (Approx.)	yds.	4370
Chamber pressure, max	lbs./sq. in.	6000
Wt. ammunition	lbs.	5.3
Wt. projectile	lbs.	2.75
Wt. T.N.T. Filler in projectile	lbs.	.6
Wt. propellent	lbs.	.93
Length overall	inches	61.6
Length of tube	inches	48.0
Calibers	cal.	20.7
Right twist (E9)	cal.	1 in 25
(E13)	cal.	1 in 30
Model Telescopic Sight		T13OE2

4. SIGHTING EQUIPMENT.—*a. General.* Sighting equipment furnished for the 57-mm recoilless rifle is as follows:

(1) Leaf type front and rear metal sights.
(2) Mount, sight, T12OE2.
(3) Telescope T13OE2.
(4) Case, carrying, T36.
(5) Light, instrument, T20.

b. Leaf type sights. (1) The front sight, (T91) is clamped around the front end of the tube. The sight leaf pivots around a pin when manually raised or lowered. The front sight is offset at an angle of approximately 45 degrees.

FIGURE 5.—Leaf Type Front Sight.

(2) The rear sight is a component of Sight Mount T12OE2. The rear sight consists of a sight leaf and slide assembly, mounted on a movable base. The sight leaf is adjustable for elevation in yards and for deflection, or leads, in mils. For elevation, the sight leaf is graduated in

100 yard increments to 1100 yards. For deflection, or leads, adjustments are made by turning the deflection knob. There are five (5) graduations right and five (5) graduations left, each being equal to 5 mils. This provides a mechanical means for allowing for high winds at long ranges, for measuring and laying off small angles, and for measuring leads.

FIGURE 6.—Rear Leaf Sight.

c. Mount, sight, T12OE2. (1) The sight mount is fastened to a bracket clamped around the tube slightly forward of the trigger. It also serves as a mount for the Telescope T13OE2 when the front and rear leaf sights are not in use and are folded down.

(2) Sight mount T120E2 contains azimuth and elevation adjusting mechanisms for bore sighting. The azimuth adjusting mechanism is operated by turning the slotted head of the azimuth worm with a screwdriver. The adjustment is locked with the azimuth clamping nut. The elevation adjusting mechanism is operated by turning the slotted head of the elevation worm with a screwdriver. The adjustment is locked with the elevation clamping nut.

d. Telescope, T13OE2. (1) The telescope T13OE2 is used for direct fire. It is a 2.8 power instrument, having a field of view of 7 degrees and 30 minutes. The telescope is provided with a front clip and rear bracket for positioning it in the Sight Mount T12OE2.

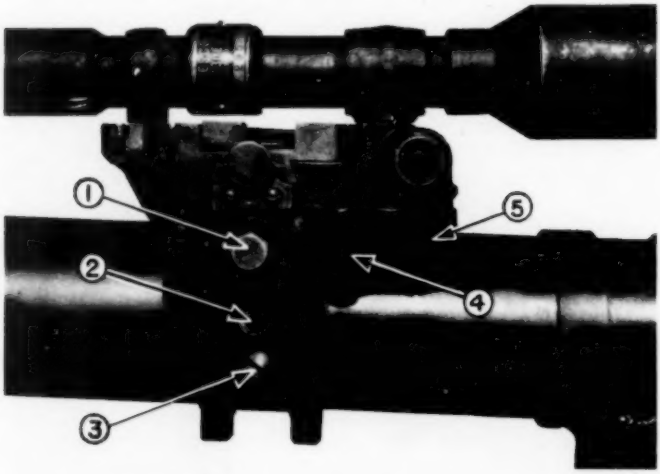


FIGURE 7.—Sight Mount, T120E2.

1. Clamping nut.
2. Elevation lock nut.
3. Elevation adjusting worm.
4. Azimuth lock nut.
5. Azimuth adjusting worm.

FIGURE 8.—Telescope, T130E2.

(2) The reticle pattern seen through the telescope is shown in Fig. 9. The reticle graduations are for use with the 57-mm rifle T15E13 when firing HE Shell T22. The sight reticle has etched graduations for ranges, or elevation, in 100 yard increments up to 1800 yards, with every 400

yards numbered. The cross at the top of the reticle pattern represents zero elevation and zero deflection, and is used when bore sighting. The broken vertical line below the cross is the vertical center of the reticle. Each part of the broken line represents a range of 100 yards. The broken horizontal lines below the cross represent elevations for 200, 400, 600, 800, 1000, 1200, 1400, 1600, and 1800 yards of range. The bottom of the vertical line represents elevation for 1900 yards. The inscription "7674280" which appears at the bottom of the field of view is the part number which identifies the reticle. The inscription "57-T22" at the top identifies the ammunition for which the reticle is graduated; namely, HE Shell T22. The reticle graduations are approximately correct for the other types of ammunition furnished for the rifle.

(3) Deflection changes and leads may be taken by using the horizontal lines opposite each 200 yard graduation. Each line and space represents 5 mils, or one (1) lead.

(4) The telescope sight has a rubber extension. This is *not* provided to absorb recoil. There are two reasons why this extension is provided: the most important reason is to position the eye the correct distance behind the sight lens; the other is to cut out light from around the eye, giving the gunner a better sight picture.

e. Light, instrument, T20. An instrument light, T20, is provided to illuminate the reticle of the telescope for night firing. A dovetail slot with a window in the side of the telescope holds the lamp bracket of the instrument light in proper position for reticle illumination.

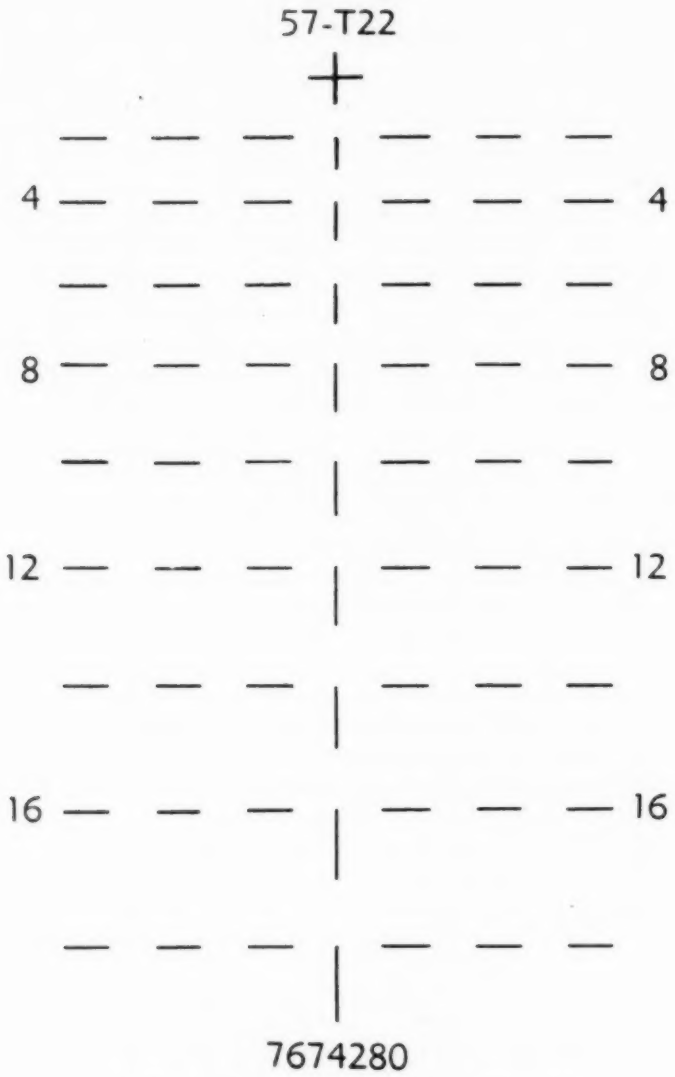


FIGURE 9.—Sight Reticle for T130E2 Telescope.

SECTION II

DISASSEMBLING AND ASSEMBLING

5. GENERAL.—*a.* Disassembly may be considered under two general headings: (1) disassembly of the rifle to the extent required for ordinary care and cleaning (field stripping), and (2) complete disassembly, under competent supervision, of all component parts for periodic cleaning.

b. The only tools necessary for complete disassembly are themselves an integral part of the rifle. The breechblock handle serves as a screwdriver, while the chamber handle serves as a socket wrench. (Where the same weapons are constantly being used for instruction, a regular screwdriver with $\frac{3}{8}$" blade is recommended to prevent undue wear on the screwdriver portion of the breechlock handle).

6. FIELD STRIPPING.—*a. General.*—Field stripping includes only the disassembly of the breechblock group. The breechblock group consists of the breechblock assembly and the breechblock carrier assembly.

b. Detailed disassembly of the breechblock group.

(1) Rotate the breechblock counterclockwise to the unlocked position, and remove the breechblock handle and chamber handle.

(2) Without opening the breech, unscrew the breechblock carrier pivot, and remove the breechblock group.

(3) Remove the breechblock cover screws, the breechblock cover, and lift out the breechblock carrier assembly.

c. Assembly of the breechblock group.

(1) The breechblock group may be assembled by inverting the order of disassembly.

d. Detailed disassembly of the breechblock assembly.

(1) Remove the firing pin from its recess in the breechblock.

(2) Remove the throat block screws and throat blocks.

(3) *Loosen* the throat ring retaining screws.

(4) Remove the extractor retaining plug, the extractor spring, and the extractor.

(5) Remove the throat ring retaining screws, and the throat ring.

e. Assembly of the breechblock assembly.

(1) Replace the throat ring, and throat ring retaining screws. *Do not tighten the throat ring retaining screws completely.*

(2) Replace the extractor spring, the extractor, and the extractor retaining plug.

(3) *Tighten completely* the throat ring retaining screws.

(4) Replace the throat blocks and the throat block screws.

(5) Replace the firing pin in its recess in the breechblock.

f. Detailed disassembly of the breechblock carrier assembly.

(1) Remove the breechblock detent screw, and breechblock detent.

(2) Remove the hammer. (Caution must be exercised to prevent injury to personnel. Hold the carrier assembly down firmly on a block of wood, a table, or similiar flat surface, with the hammer housing up, and push the sear lever toward the hammer. This releases the tension of the firing spring, and the hammer may now be removed.)

(3) Remove the sear lever axis pin and sear lever.

(4) Unscrew the sear plug, and remove the sear spring and sear.

(5) Remove the firing spring.

g. Assembly of the breechblock carrier assembly.

(1) Replace the firing spring.

(2) Replace the sear, the sear spring, and sear plug. Screw the sear plug in until it is flush with the face of the breechblock carrier, but no farther.

(3) Replace the sear lever, and the sear lever axis pin.

(4) Replace the hammer. (A suggested method is to place the chamber handle, with threaded portion up, on a table or block of wood. Insert the hammer in the hammer housing, and place the hammer on the chamber handle. Press down firmly until the sear engages the hammer and holds it in the cocked position.)

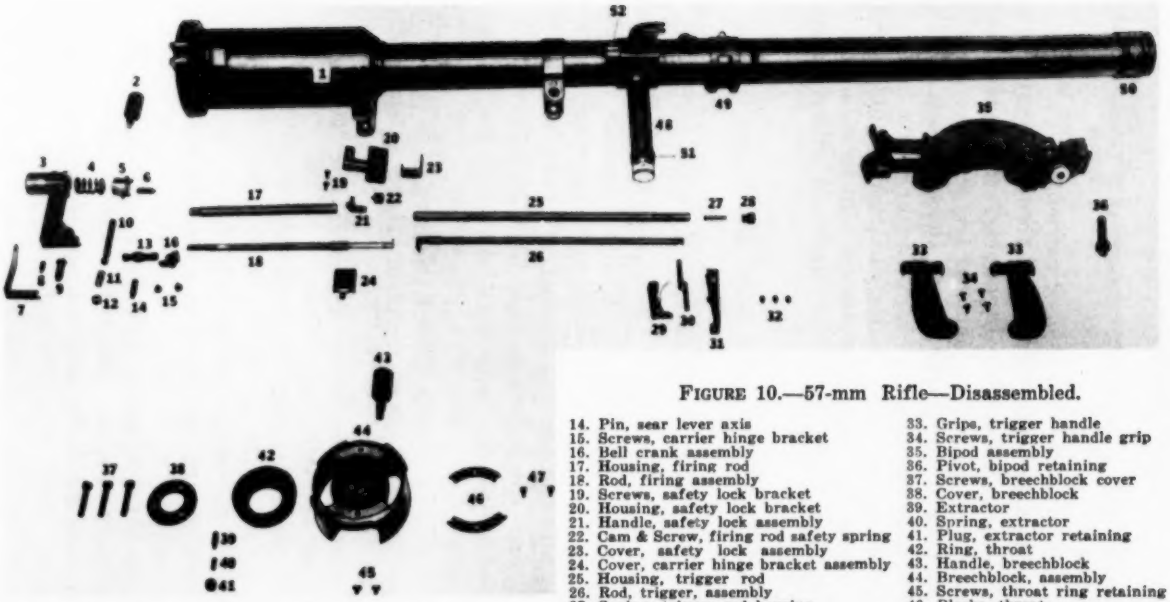


FIGURE 10.—57-mm Rifle—Disassembled.

1. Barrel assembly (tube & chamber)
2. Handle, chamber
3. Carrier, breechblock assembly
4. Spring, firing
5. Hammer, assembly
6. Pin, firing
7. Detent, breechblock
8. Screw, detent, breechblock
9. Pivot, breechblock carrier
10. Sear
11. Spring, sear
12. Plug, sear
13. Lever, sear
14. Pin, sear lever axis
15. Screws, carrier hinge bracket
16. Bell crank assembly
17. Housing, firing rod
18. Rod, firing assembly
19. Screws, safety lock bracket
20. Housing, safety lock bracket
21. Handle, safety lock assembly
22. Cam & Screw, firing rod safety spring
23. Cover, safety lock assembly
24. Cover, carrier hinge bracket assembly
25. Housing, trigger rod
26. Rod, trigger, assembly
27. Spring, trigger rod housing
28. Plug, trigger rod housing
29. Safety, and safety spring, trigger assembly
30. Link, trigger rod operating
31. Trigger
32. Pivots (safety, operating link, & trigger)
33. Grips, trigger handle
34. Screws, trigger handle grip
35. Bipod assembly
36. Pivot, bipod retaining
37. Screws, breechblock cover
38. Cover, breechblock
39. Extractor
40. Spring, extractor
41. Plug, extractor retaining
42. Ring, throat
43. Handle, breechblock
44. Breechblock, assembly
45. Screws, throat ring retaining
46. Blocks, throat
47. Screws, throat block
48. Handle, extendable, assembly
49. Bracket, sight mounting
50. Bracket, front sight
51. Ferrule, extendable handle slide sleeve
52. Bracket, trigger assembly

(5) Replace the breechblock detent and breechblock detent screw.

7. DISASSEMBLY FOR PERIODIC CLEANING.—*a. General.* Disassembly for periodic cleaning will include the removal of the breechblock group, the trigger group, and the firing linkage. Removal of the front sight, rear sight mounting bracket and rear open sight.trigger handle bracket, monopod, monopod bracket, carrier bracket, or any other parts not specifically mentioned herein, will be done only by ordnance personnel or under the supervision of ordnance personnel.

b. Detailed disassembly of the firing linkage and trigger group.

(1) Remove the carrier hinge bracket cover screw and carrier hinge bracket cover.

(2) Remove the bell crank pivot and bell crank.

(3) Remove the safety lock cover.

(4) Loosen the firing rod safety spring cam screw.

(5) Remove the safety lock handle.

(6) Remove the firing rod safety spring cam.

(7) Remove the four trigger handle grip screws and trigger handle grips.

(8) Remove the trigger pivot and trigger.

(9) Remove the trigger safety pivot, trigger safety, and trigger safety spring.

(10) Remove the trigger rod operating link pivot and the trigger rod operating link.

(11) Remove the trigger rod housing plug and the trigger rod spring.

(12) *Loosen* the trigger rod housing clamp nut.

(13) Withdraw the trigger rod housing (toward the front of the rifle).

(14) Remove the trigger rod (withdraw toward the rear of the rifle).

(15) Remove the safety lock bracket screws and safety lock housing.

(16) Remove the firing rod housing, and withdraw the firing rod.

c. Assembly of the firing linkage and trigger group.

(1) Replace the firing rod in the firing rod housing.

(2) Replace the firing rod housing in the slot of the breechblock carrier bracket.

(3) Replace the safety lock housing and the safety lock bracket screws.

(4) Replace the trigger rod housing in the slot of the trigger handle bracket, and replace the trigger rod in the housing, inserting it from the rear.

(5) Replace the trigger rod spring and trigger rod housing plug.

(6) Replace the trigger rod operating link and trigger rod operating link pivot.

(7) Replace the trigger safety and safety spring, and the trigger safety pivot.

(8) Replace the trigger and trigger pivot.

(9) Replace the firing rod safety spring cam.

(10) Replace the safety lock handle, and tighten the firing rod safety spring cam screw.

(11) Replace the bell crank and the bell crank pivot.

(12) *Tighten* the trigger rod housing clamp nut.

(13) Test the firing linkage and trigger group for proper assembly.

(14) Replace the trigger handle grips and the four trigger handle grip screws.

(15) Replace the safety lock cover.

(16) Replace the carrier hinge bracket cover and carrier hinge bracket cover screw.

SECTION III
MECHANICAL FUNCTIONING

8. GENERAL.—*a.* The soldier should have a practical working knowledge of the mechanical operation of the rifle so that he will be able to keep it in action during combat.

b. Although many phases of functioning of the 57-mm recoilless rifle take place simultaneously, the entire subject of functioning is divided into phases to facilitate instruction. The explanation of mechanical functioning begins with the assumption that the rifle has just been fired.

c. Instruction is divided into phases as follows:

(1) Opening the breech.
(2) Closing the breech.
(3) Firing the piece.
(4) Safety features.

9. OPENING THE BREECH.—*a. Unlocking.*—When the breechblock has rotated counterclockwise approximately 40 degrees, the locking lugs on the breechblock are no longer in contact with the locking recesses in the chamber and the breechblock is free to be pivoted to the rear. The breech is held in its unlocked position by the action of the breechblock detent which is engaged with the detent recesses of the breechblock cover.

b. Cocking. Simultaneously with the unlocking, the rifle is cocked as the breechblock is rotated counterclockwise. The cocking lugs on the hammer, riding against the cocking cams in the breechblock, cam (or force) the hammer to the rear against the pressure of the firing spring. After the hammer has moved approximately one-half (1/2) inch to the rear, the sear, under the action of the compressed sear spring, moves toward the face of the hammer and the hammer notch of the sear engages the hammer, holding it in the cocked position.

c. Extraction. When the breech is in a closed position, the notch on the extractor is positioned in front of the rim of the cartridge, and as the breechblock swings to the

rear, the extractor withdraws the cartridge case approximately two inches. At that point, the two parts disengage. The case is then withdrawn by hand.

10. CLOSING THE BREECH. Assume that a new round has been positioned in the chamber.

a. Positioning of the extractor. When the breechblock is rotated into the breech, the head of the extractor comes in contact with the rim of the cartridge and is cammed back into its recess in the breechblock. As soon as the breechblock has been swung completely forward into the breech, the extractor is free to snap out of its recess, under the action of the compressed extractor spring, and engage the rim of the cartridge. Extraction is now possible when the breech is opened.

b. Locking. The breech is closed at this point, but not locked. The final movement is to rotate the breechblock clockwise. At this time the locking lugs engage with the locking recesses in the chamber. As the breechblock is rotated, the hammer, under the action of the compressed hammer spring, moves forward to engage the hammer notch of the sear. This rotation is stopped when the breechblock carrier comes in contact with the side of the breechblock. The breech is held in its locked position by the action of the breechblock detent which is engaged with the detent recesses on the breechblock cover.

11. FIRING THE PIECE.—*a.* The mechanism required to fire the rifle is contained in the breechblock carrier assembly, the firing linkage, and the trigger group.

b. Before the firing linkage can function, the safety lever must be rotated from "S" to "F". This movement rotates the firing rod safety spring cam, which in turn cams or forces the firing rod safety spring into position to engage the catch of the trigger rod in the small square hole in the firing rod safety spring. The firing linkage will now function as one rod.

FIGURE 11.—Loaders Safety Disengaged.

FIGURE 12.—Loaders Safety Engaged.

c. Upon depression of the trigger, the trigger rotates on the axis of the trigger pivot, and the stud on the trigger comes in contact with the trigger rod operating link, forcing the forward (lower) arm to the rear. However, the projection stop of the grip safety is in position to block this movement. Depression of the grip safety causes it to rotate around the trigger safety pivot, and the projection stop is moved down to a position where it can no longer block the movement of the trigger rod operating link.

d. With this mechanical block removed, the trigger rod operating link rotates on its pivot, and this movement moves the rear (upper) arm forward. As the operating link is positioned in the link notch of the trigger rod, movement of the operating link also moves the trigger rod forward, and compresses the trigger rod spring against the trigger rod housing plug.

e. Since the trigger rod and the firing rod are now connected at the safety lock, movement of the trigger rod forward also moves the firing rod forward. In turn, the firing rod is connected to the bell crank by means of the pin of the bell crank being engaged in the bell crank pin recess of the firing rod, and movement of the firing rod rotates the bell crank on the bell crank pivot.

f. As the bell crank rotates on its axis, the single projection comes in contact with the long arm of the sear lever.

g. Pressure on the sear lever causes it to rotate, and since it is pivoted in the center, the short arm of the sear lever moves in the opposite direction.

h. The sear lever is connected to the sear by means of a yoke on the end of the sear lever which is engaged in the sear lever notch of the sear. Movement of the sear lever is then transmitted to the sear.

i. The sear moves downward, compressing the sear spring against the sear plug. The hammer notch on the sear is then no longer in position on the hammer and the hammer is free to move forward.

j. The hammer is forced forward under action of the firing spring. After moving approximately one-half (1/2) inch, the hammer comes in contact with the rear face of the firing pin.

k. The force of the hammer drives the firing pin forward, causing the striker to protrude through the firing pin aperature of the breechblock, and strike the primer of the cartridge.

l. As previously explained, cocking of the rifle compresses the firing spring, and also releases the sear spring as the sear moves into position to engage the hammer. The sear lever is also rotated and moves the bell crank back to its former position. Rotation of the bell crank is stopped as the double projection comes in contact with the breechblock carrier bracket.

m. Since the bell crank pin is inserted in the recess of the firing rod, rotation of the bell crank moves the firing rod to the rear. This movement is assisted by the pressure of the trigger rod spring which forces the trigger rod to the rear.

n. Up to this point, it has been assumed that the firing rod and trigger rod were still connected. Actually, they are not. As the trigger is depressed, and the trigger rod moves forward, the catch on the trigger rod moves the firing rod safety spring cam, and the pressure of the firing rod safety spring completes the rotation of the cam to the point where it no longer forces the firing rod safety spring upward. This permits the catch on the trigger rod to become disengaged from the slot in the firing rod safety spring. Therefore, the firing rod and the trigger rod are no longer connected. This action occurs as each shot is fired, and the safety lock lever must again be rotated from "S" to "F" before the piece can be fired.

12. SAFETY FEATURES.—*a.* There are three safety features which are provided to prevent involuntary actuation of the firing mechanism. They are the grip safety, safety lock, and a completely closed and locked breechblock.

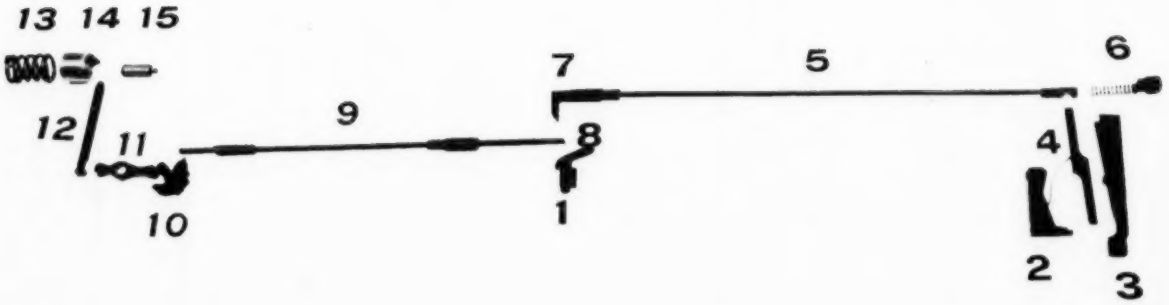


FIGURE 13.—Firing Linkage.

1. CAM, firing rod safety spring
2. SAFETY, trigger assembly
3. TRIGGER assembly
4. LINK, trigger rod operating
5. ROD, trigger assembly
6. SPRING, trigger rod, & PLUG, trigger rod housing
7. CATCH, trigger rod
8. HANDLE, safety lock assembly
9. ROD, firing assembly
10. BELLCRANK, assembly
11. LEVER, sear
12. SEAR
13. SPRING, firing
14. HAMMER
15. PIN, firing

b. The operation of the grip safety and safety lock are described in paragraphs 11*b*, *c*, and *n*.

c. If the hammer is released prior to complete rotation of the breechblock, the hammer will move forward until its cocking lugs come in contact with the cocking cams on the breechblock. This prevents contact between the hammer and firing pin. When the breech is locked and the trigger depressed, the hammer completely seats, actuating the firing pin.

13. ACTION OF GASES.—When the propellant charge is detonated a chemical reaction transforms the solid powder into a mass of hot gases which blow and burn their way through the kraft paper container within the shell case and escape through the perforations. The gases have a tendency to expand in all directions with equal force. The force exerted against the end of the projectile pushes it forward through the tube. The force exerted against the solid portions of the breechblock causes enough recoil to balance the forward thrust caused by the friction of the projectile against the walls of the tube. The orifices in the breechblock are also canted so that the gases are given a twisting motion as they escape to the rear. The resulting rotational thrust on the tube is equal and opposite to the rotational thrust caused by the projectile as it spins forward through the tube. The piece therefore remains motionless when fired.

SECTION IV

STOPPAGES AND IMMEDIATE ACTION

14. GENERAL.—*a.* This section deals with stoppages, immediate action, and the actions necessary to eliminate recoil should it occur.

b. A stoppage is any unintentional cessation of fire.

c. Immediate action is the procedure used for the prompt reduction of usual stoppages.

d. The balance of the rifle is disturbed when excessive erosion occurs, and the rifle moves forward when fired.

15. STOPPAGES.—*a. Prevention of stoppages.* Stoppages will be reduced to the minimum if the gunner has a practical working knowledge of his rifle, makes the proper inspections, and takes appropriate preventive action *before, during* and *after firing.*

b. Causes for stoppages. (1) Stoppages which occur are failure to fire, failure of the breech to open, failure to extract, and failure to load.

(a) Failure to fire may be caused by:
Defective ammunition.
Broken firing pin.
Breech not locked.
Weak or broken firing spring.
Broken firing rod safety spring.
Improper assembly of the firing linkage or trigger group.
Failure of the loader to move safety lock handle from "S" to "F".

(b) Failure of the breech to open will be caused by failure to remove oil from the breechblock and chamber before firing. This oil causes carbon accumulation and "freezing" of the breechblock to the point where it will not open.

(c) Failure to extract may be caused by:
Burred or broken extractor, or broken extractor spring.
Improper assembly of the extractor or throat ring.
Extractor frozen in place by carbon accumulation.
Loose positioning band permits the round to go too far forward.

(d) Failure to load may be caused by:
Improper mating of the pre-engraved rotating band with the lands and grooves.
Burred rotating band.
Positioning band forward of proper position.
Excessive diameter of fuze body (usually HEAT).
Excessive varnish or paint on rotating band.

16. IMMEDIATE ACTION.—*a. General.* The procedure prescribed in immediate action for the reduction of stoppages is based on the frequency with which the various types of stoppages occur. Execution of this procedure by the assistant gunner will enable him to remedy the majority of stoppages immediately without attempting to analyze the cause.

b. Duties. Immediate action is performed by No. 2, the assistant gunner. The gunner, as well as all other members of the squad, will be alert to assist No. 2.

c. Procedure. The procedure for immediate action is shown below:

Rifle fails to fire
No. 1 calls "MISFIRE".
No. 2 waits sixty (60) seconds, recocks, sets the safety lever on "F", and taps No. 1.
No. 1 relays, and attempts to fire.
If rifle still fails to fire
No. 1 calls "MISFIRE".
No. 2 opens the breech, and inspects the primer.
If the primer is dented:
No. 2 loads a new round, sets safety lever on "F", taps No. 1.
No. 1 relays, and attempts to fire.
If the primer is not dented:
No. 2 cleans the firing pin aperture, the tip of the firing pin, the face of the breechblock, and inspects for a broken firing pin.

17. RECOIL.—*a. Forward Movement.* (1) If the rifle has a forward movement during firing, it indicates that excessive erosion has occured on the throat ring, chamber, throat block, or breechblock, and the balance should be restored by changing throat rings.

(2) Each throat ring has a number stamped on it. There are seven different sizes of rings. Six range from 2.98 to 3.08 inches in increments of 0.02 inch, and the seventh ring is 3.12 inches in diameter.

(3) The ring having the next highest number should be inserted in the breech. This will generally eliminate forward movement; however, if the gun still moves forward, the next higher numbered ring should be used.

(4) When a throat ring is replaced, the throat blocks should also be replaced. The blocks are stamped with a number to correspond with the ring number. (Make sure that the block with the *extractor* relief cut is assembled on the *extractor* side of the breechblock.)

b. Rearward movement. If the rifle recoils to the rear, it indicates that a throat ring of too large a size is being used, and the ring and blocks should be replaced with a ring having the next smaller number, and new throat blocks.

SECTION V

CARE AND CLEANING—57-mm RECOILLESS RIFLE

18. GENERAL.—The service to be performed upon receipt of new, or used equipment will be in accordance with normal procedures for standard weapons.

19. PREVENTATIVE MAINTENANCE.—*a. Before Firing.* The proper execution of maintenance before firing will eliminate most stoppages and causes for accidents. The most important things to be checked before firing are:

(1) Remove *all* oil from the bore, chamber, and breechblock.

(2) Check the throat ring for proper size as shown for that particular rifle in the Gun Book. Also, check the throat ring for proper tightness. Throat ring retaining screws should be tightened all the way, then unscrewed one-quarter turn to prevent "freezing" during firing.

(3) Inspect the firing pin aperture for cleanliness.

(4) Inspect the extractor for proper functioning.

(5) Test the firing mechanism.

(6) Check the sights for proper mounting, and tightness in the sight mount.

b. During Firing. (1) Precaution should be taken to prevent the throat ring and throat blocks from becoming "frozen" during firing. To prevent this, during lulls in the firing, loosen the throat ring retaining screws, and retighten. The same precaution should be exercised with regard to the throat blocks.

(2) Inspect frequently to keep the firing pin aperture clean and clear.

c. After Firing. (1) When the bore and chamber have cooled sufficiently to permit handling with the bare hands, thoroughly clean the bore, chamber, and breechblock with bore cleaner. The heat of the rifle will not then destroy some of the chemical properties of bore cleaner. If the rifle is not to be fired again the next day, it must be cleaned again for three (3) consecutive days thereafter. Thoroughly dry and apply a light coat of oil.

(2) If the rifle is to be fired the next day, bore cleaner has sufficient rust preventing qualities to prevent rusting for periods of 24 to 48 hours without adding a coat of oil.

(3) After firing, the breech mechanism should be completely disassembled, cleaned, oiled, and assembled.

(4) If rust should accumulate, its removal from bearing surfaces requires special care in order that clearances should not be unduly increased. CROCUS CLOTH should be used for this purpose. *The use of coarse abrasives is strictly forbidden.* Carbon accumulation may be removed by applying a light coat of oil, then using crocus cloth to remove the carbon.

(5) If bore cleaner is not available, soda ash, soap, or hot water should be used in the priority as listed.

(6) The oil prescribed for use is engine oil, SAE 30 above plus 32 degrees F; SAE 10 from plus 32 degrees F to 0 degrees F; Preservative lubricating oil (Special) below 0 degrees F.

(7) The use of gasoline for cleaning purposes is prohibited.

(8) For further information on the qualities of bore cleaner, see W. D. T. B. Ord. 259, 5 March 1945.

(9) For care of sights, follow pertinent ordnance directives.

(10) For storage and shipment of the rifle, follow pertinent ordnance directives.

SECTION VI
AMMUNITION AND FUZES

20. GENERAL.—Ammunition for the 57-mm recoilless rifle T15E13 is issued in the form of complete rounds of fixed ammunition. The round consists of a primer and propelling charge in a perforated cartridge case which is crimped rigidly to the projectile. The term "fixed", used in this connection, signifies that the propelling charge is not adjustable and that the round is loaded into the weapon as a unit.

21. DESCRIPTION AND IDENTIFICATON.—Ammunition for the 57-mm recoilless rifle may be easily identified from other fixed ammunition by its perforated cartridge case and pre-engraved rotating band. The pre-engraving of the rotating band permits the use of lower chamber pressures which in turn permit thinner chamber walls with a resultant weight reduction in the rifle. The perforation of the cartridge case is provided to permit the escape of gases into the chamber and thus utilize these gases to eliminate recoil. The casing must be crimped rigidly to the projectile so that the casing will not turn independently when the round is placed in the chamber and the pre-engraved rotating band mated with the lands and grooves of the tube. A positioning band is provided to insure proper headspace adjustment between the primer of the cartridge and the firing pin. The propellant is retained within the perforated casing by a thin tube of kraft paper, 0.004″ thick. Caution must be exercised in handling ammunition to prevent damage to this paper. Puncturing of the paper will result in a loss of propellant with a resulting loss of range and accuracy. Moisture will also damage the rounds, and precautions must be exercised to keep the ammunition dry. To protect the ammunition from such damage, each round is packed in a moisture-resistant fiber container enclosed in a sealed metal container, and in turn in a wooden packing box. Ammunition for the 57-mm recoilless rifle cannot be used in any other 57-mm weapon.

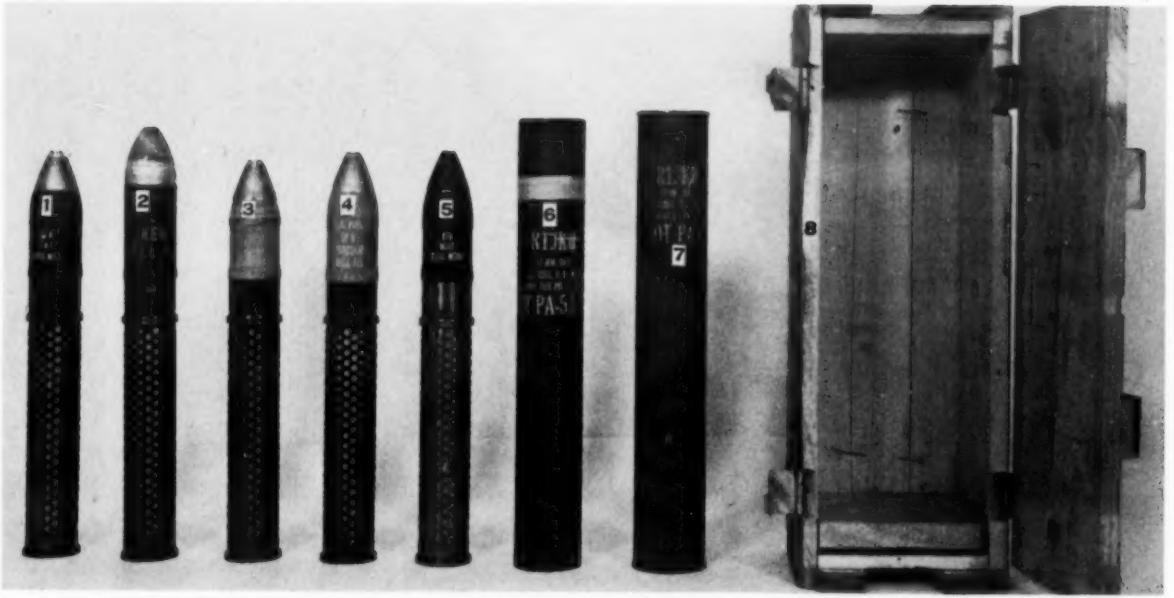


FIGURE 14.—57-mm Recoilless Rifle Ammunition.

1. CARTRIDGE, HE M306 (T22)
2. CARTRIDGE, HEAT, M307 (T20E2)
3. CARTRIDGE, Smoke, WP M308 (T23)
4. CARTRIDGE, Target Practice (TP) T22
5. CARTRIDGE, HE, Inert, M306 inert loaded, dummy fuzed
6. CONTAINER, fiber, moisture resistant
7. CONTAINER, Metal, sealed
8. PACKING CRATE, wood

22. CLASSIFICATION.—Dependent upon the type of projectile, ammunition for the 57-mm recoilless rifle is classified as high explosive (HE), high explosive antitank (HEAT), chemical (SMOKE, WP), inert (IN), and target practice (TP).

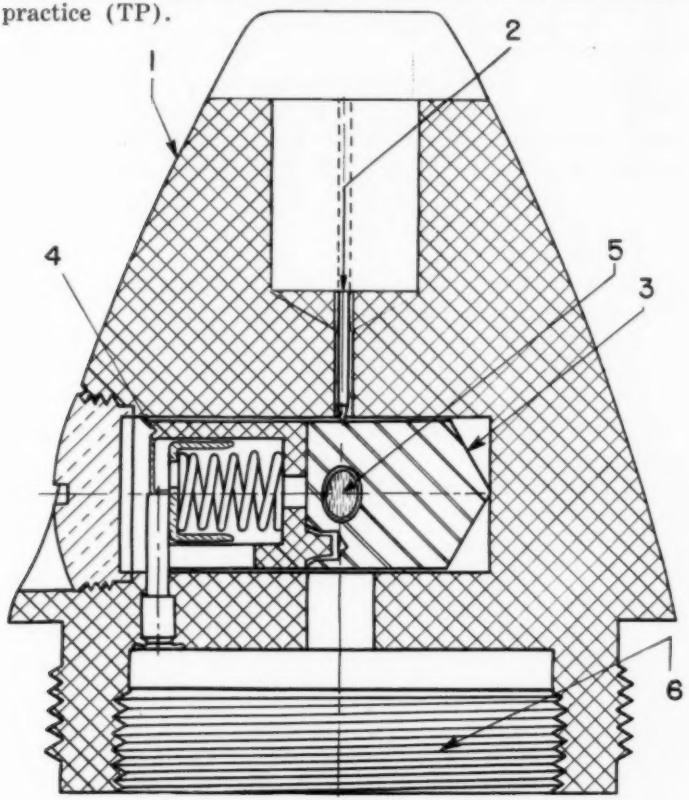


FIGURE 15.—Fuze M89 (P.D. T119 Modified).
For Shell HE (M306) 57-mm Recoilless Rifle.

a. The HE projectile (fig. 15) is a comparatively thin-walled projectile containing a high explosive bursting charge, and is used principally for fragmentation effect against personnel and open type emplacements. It has a total weight of 2.66 lbs., end contains .6 lbs. granulated

TNT. It is equipped with Fuze M-89 (PD T119E1). The projectile has a bursting radius of 17 yards. Its muzzle velocity of 1200 feet per second produces a maximum range of 4340 yards. The fuze is point detonating and is armed when the projectile attains a speed of 2000 rpm. When the round is fired a rotating motion is imparted to the projectile by the rifling of the tube. Centrifugal force tends to force the rotor (3) and rotor lock (4) apart. The rotor cannot move, but the force of inertia caused by acceleration of the projectile, plus the force of friction, prevents the rotation of the rotor while the projectile is in the tube. Shortly after the projectile leaves the tube, the rotor is rotated in its cavity by centrifugal force, alining the primer with the firing pin (2). Upon impact the fuze body (1), is crushed against the firing pin (2) which in turn strikes the primer (5), detonating the booster pellet contained within the booster cup (6) and setting off the TNT in the projectile.

b. The HEAT projectile is designed for use against armored targets and will penetrate 3½ inches of armor plate at maximum range at angles of impact of less than 30 degrees to the normal. This projectile also has a velocity of 1200 feet per second and a maximum range of 4340 yards. The HEAT projectile (fig. 16) employs a point initiating fuze, M-90 (PI-T-123E1). The explosive in the projectile is a shaped charge detonated at its base. The armor penetrating ability of a solid projectile depends upon its weight, velocity at time of impact, and angle of strike. By employing the principle of a shaped charge, penetration remains the same even though the muzzle velocity is greatly reduced. The projectile in this case weighs 2.70 lbs. The explosive in the projectile is composed of 50% pentolite and 50% TNT. Here again the fuze is armed at 2000 rpm in the same manner as the M-89 fuze. On contact with the ground the ogive (1) is dented and strikes the firing pin, detonating the primer which sets off the auxiliary detonator (5). This detonator is a small shaped charge which passes along a flash channel (6) detonating the base primer (7) which in turn detonates the main charge (8).

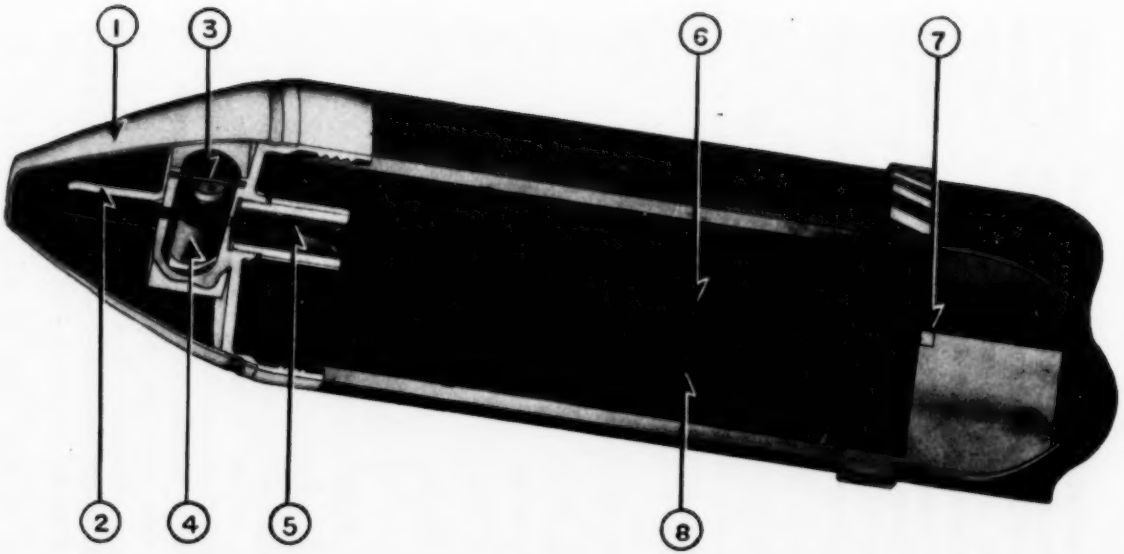


FIGURE 16.—Fuze M90 PI T123E1—For HEAT Projectile.

1. Ogive.
2. Firing Pin Assembly.
3. Rotor Lock Assembly.
4. Rotor Assembly.
5. Auxiliary Detonator.
6. Flash Channel.
7. Base Primer.
8. Main Charge.

c. The chemical round provided is SMOKE, WP, which is used for a screening effect, and incendiary action, or a combination of the two. The ballistic qualities of the round are the same as the high explosive round; however, the bursting radius is approximately 15 yards.

d. INERT ammunition has the same ballistic characteristics as the HE round, except there is no high explosive in the projectile.

e. The TARGET PRACTICE round is an inert round which contains a small spotting charge.

23. GENERAL CHARACTERISTICS OF ALL AMMUNITION FOR 57-MM RECOILLESS RIFLE.

	HE	HEAT	WP	TP or INERT
Weight of round (approx.) ..... lbs.	5.33	5.25	5.30	5.30
Wt. of projectile (approx.) ..... lbs	2.66	2.70	2.66	2.70
Wt. of propellent (approx.) ..... lbs.	.93	.93	.93	.93
Length of round ..... in.	18.60	19.60	18.60	18.60
Wt. of round in fiber and metal container ..... lbs.	7.38	7.26	7.20	7.20
Wt. of box of ammunition ..... lbs.	44.00	44.00	44.00	44.00
Fuze	PD M89	M90	PD M89	
Spec. No. of ammunition	M-306	M-307	M-308	T-22

SECTION III

BORE SIGHT ADJUSTMENT

24. DEFINITION.—*a.* Bore sighting is the process or series of operations by which the axis of the bore of the weapon and the line of sight are made parallel, or are made to converge on a distant point. The term bore sighting is sometimes referred to as "zeroing", "targeting" or the more general term "adjustment of sights".

b. Preliminary settings. The tripod or bipod should be set up in a stable position, fairly level, with the legs embedded in firm ground.

25. VERIFICATION BY DISTANT TARGET METHOD.—*a.* When bore sighting by this method, the line

of sight of the telescope and the axis of the bore of the rifle converge on a clearly defined point 1000 yards or more distant.

b. To determine the axis of the bore, place cross hairs on the muzzle of the bore, and remove the breechblock carrier and firing pin. This will provide an aperture for sighting. A 75-mm shell case, cut off at the first perforation, with the primer punched out, may be inserted in the chamber in lieu of removal of the firing pin.

c. Elevate or depress the rifle, and traverse it until a clearly defined aiming point is seen through the bore.

d. Without disturbing the lay of the rifle, sight through the telescope and note the relationship between the cross of the reticle pattern and the aiming point. This sight picture should be the same as noted through the bore of the rifle. If the two sight pictures do not coincide, adjustment is required. Adjust the line of sight by first loosening the lock nut just below the deflection knob of the rear sight. Adjust elevation of the sight by loosening the elevation lock nut and turning the elevation adjusting worm. The elevation adjustment is on the side of the sight mount, below the telescope holder. The azimuth adjustment is underneath the telescope holder. Adjust the azimuth of the sight by loosening the azimuth lock nut and turning the azimuth adjusting worm. When the sight is properly alined on the target, lock the elevation and azimuth lock nuts, and tighten the lock nut just below the deflection knob of the rear metal sight. This lock nut holds the sight in adjustment. (See fig. 7.)

26. BORE SIGHTING LEAF-TYPE METAL SIGHT.—To bore sight the rifle for firing with the metal sights, determine the axis of the bore as in par 25*b* above. Adjust the front sight blade until it is alined on the target, making minor adjustments on the rear sight by adjusting the elevation and azimuth worms as in 25*d* above. (See fig. 5.)

27. NECESSITY FOR BORE SIGHTING.—It is absolutely essential to accuracy of the rifle that it be properly bore sighted. Inaccuracy in bore sighting will be directly reflected in the ability of the gunner to hit the target, and his ability as a marksman affected. Therefore, each gunner should be instructed and tested in proper boresighting during his marksmanship training.

CHAPTER 2

Mechanical Training
75-mm Recoilless Rifle

Section I	General
Section II	Disassembly and Assembly
Section III	Mechanical Functioning
Section IV	Stoppages and Immediate Action
Section V	Ammunition and Fuzes
Section VI	Care and Cleaning
Section VII	Mountings
Section VIII	Sights and Bore Sighting

SECTION I

GENERAL

1. DESCRIPTION.—*a.* The 75-mm Rifle M20 (Fig. 17) is a recoilless portable weapon designed to be fired from the Machine Gun Tripod Mount Cal. .30 M1917A1. It is an air-cooled, single shot, breech-loading weapon using fixed ammunition. The rifle is equipped with a manually operated breech mechanism and a percussion type firing mechanism.

b. Tabulated data:

(1) General

Weight of rifle	lbs. 105
Weight of rifle complete w/mount & sight	lbs. 166
Length of rifle	in. 82
Length of bore	in. 65
Length of rifling	in. 65
Type of breechblock	Interrupted screw

(2) Performance

Muzzle velocity HE & WP	fs 990
Muzzle velocity HE AT	fs 1000

Range (approximate maximum)
Cartridge HEAT T39
for 75-mm Rifle M20 ..... yds. 7200
Cartridge HE T38
for 75-mm Rifle M20 ..... yds. 7450
Cartridge smoke WP T40
for 75-mm Rifle M20 ..... yds. 7450

c. Data pertaining to mount M1917A1. See Section VI, Chapter I, FM 23-55.

d. Sighting Equipment:

(1) Indirect Fire Sight E19 consisting of:
Elevation Quadrant
Telescope Adapter
Elbow Telescope
Instrument Light
Carrying Case

(2) Direct Fire Sight M85c consisting of:
Telescope Mount
Telescope
Instrument Light
Carrying Case

2. PRINCIPLE OF OPERATION.—The shell casing for recoilless ammunition is perforated so that the propellant gases can escape through the perforations into the enlarged chamber. The breech is so constructed that, on ignition of the propellant charge, the resultant gases are allowed to escape to the rear through orifices in the breechblock, thereby partially eliminating recoil force. These gas escape orifices are so constructed in shape and so adjusted in size that, upon firing, every force acting on the tube-chamber assembly is neutralized by an equal and opposite force and the gun remains motionless.

FIGURE 17.—75-mm Rifle M20 Mounted on Heavy MG Tripod M1917A1, showing the indirect fire sight E19.

SECTION II

DISASSEMBLY AND ASSEMBLY

3. GENERAL.—A knowledge of the procedure of disassembly and assembly is a prerequisite to an understanding of functioning and stoppages, and to an ability to perform immediate action to reduce stoppages. The process of normal care and cleaning also requires a knowledge of these subjects. The following paragraphs outline a standardized, step by step, method of disassembling and assembling.

4. DISASSEMBLY.—The Allen wrenches contained in the breech handle are the only tools needed to field strip the rifle. The preliminary steps and the disassembly of the parts are accomplished in the order indicated below:

a. Open the breech, check the chamber to see that it is clear, close the breech, and actuate the firing mechanism.

b. Remove the four socket head cap screws (breech handle assembly screws) which fasten the breech handle assembly to the breech block, and remove the breech handle assembly, being careful not to lose the breech lock and spring.

c. Remove the breech lock and spring.

d. Remove the firing pin, hammer assembly, and the firing spring from the hammer housing.

e. Remove the two cam rollers from the hammer housing.

f. Lift out the sear cover.

g. Rotate the safety ¼ turn counterclockwise, depress the trigger, continue the counterclockwise rotation of the safety for another ¼ turn, then lift out the trigger safety assembly being careful not to displace the trigger key from its recess.

h. Remove the sear.

i. Rotate the breech block to the unlocked position and open the breech. Lift the breech block off of the hinge.

j. Withdraw the extractor from its seat in the hinge, taking care not to lose the extractor spring, and then withdraw the extractor spring.

k. Remove the cam rollers from the hinge.

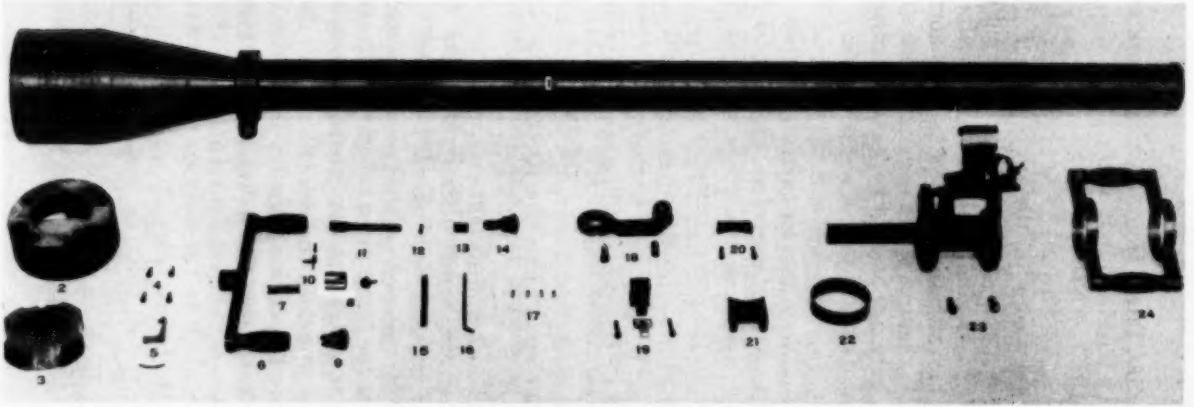


FIGURE 18.—75-mm Rifle M20—Disassembled.

1. Tube chamber assembly
2. Venturi insert
3. Breech block
4. Breech handle assembly screws
5. Extractor & extractor spring
6. Breech handle assembly
7. Firing spring
8. Hammer & firing pin
9. Breech handle cap
10. Breech lock & spring
11. Trigger
12. Trigger pin
13. Trigger spring
14. Safety
15. Sear cover
16. Sear
17. Cam rollers
18. Breech hinge, hinge pin & hinge pin screw
19. Breech hinge block, shim & screws
20. & 21. Front mounting bracket & screws
22. Front mounting bracket ring
23. Telescope mount & screws
24. Tube carrying handle assembly

l. Remove the hinge pin screw from the hinge block and remove the hinge pin by pushing it out of the block.

m. Remove the hinge.

n. The weapon is now stripped for normal care and cleaning. There are five additional disassemblies which may be undertaken, under competent supervision, for periodic cleaning. They are:

(1) Separation of firing pin from the hammer.

(2) Removal of breech hinge block.

(3) Removal of tube carrying handles and front mounting bracket.

(4) Removal of telescope mount.

(5) Disassembly of the trigger and safety assembly.

o. The venturi insert is screwed into the rear end of the chamber and locked in place by the hinge pin screw which passes through the chamber wall into a hole in the insert. The choke ring and the interrupted threads, which engage the breech block, are an integral part of the insert. These parts may be removed by Ordnance maintenance personnel only.

5. ASSEMBLY.—The weapon is assembled in approximately the reverse order of disassembly.

a. Place the hinge in position so that it straddles the hinge block, and insert the hinge pin so that the notch in the pin faces to the rear.

b. Insert and tighten the hinge pin screw making certain that the point on the screw enters the hole in the venturi insert.

c. Replace the cam rollers in the hinge.

d. Insert the extractor spring into its recess in the hinge. This spring may be inserted with the curved surface either up or down.

e. Insert the extractor into the recess in the hinge so that the hook is pointing away from the hinge block.

f. Place the breech block on the hinge making certain that the projection on the lower end of the extractor enters the cam slot in the breech block.

g. Close the breech and rotate the breech block to the locked position.

h. Replace the sear in its slot in the breech handle assembly so that the tapered end is toward the hammer housing and the bent end is in the trigger handle.

i. Insert the trigger and safety assembly into the trigger handle so that the studs of the safety become engaged in the slots in the trigger handle. Revolve the trigger key clockwise until it is lined up with the lugs on the safety. In order to complete this operation it is necessary to depress the trigger. Before this assembly can be fully seated in the trigger handle, the sear recess in the base of the trigger must be in position to receive the bent end of the sear. When the assembly is completely seated the safety will revolve and retain it in place.

j. Place the sear cover over the sear slot in the breech handle with the curved end up.

k. Replace the two cam rollers in their recesses in the hammer housing.

l. Center the firing spring in the hammer housing. Place the hammer-firing pin assembly over the firing spring with the cam rollers positioned in the two square slots, and the sear notch in position to engage the sear. (Caution: Be sure that the hammer is replaced so that the sear notch is opposite the sear. If the hammer is replaced backwards—i.e. so that the sear notch is opposite the breech lock—the breech lock will engage the hammer in the cocked position when the piece is cocked. Manual operation of the breech lock will then release the hammer. This situation is extremely dangerous if the breech is closed on a live round as the only way the breech may be reopened is to disengage the breech lock manually.)

m. Replace the breech lock and spring into their recess in the breech handle assembly.

n. Holding the breech lock pin, place the breech handle assembly against the breech block so that the trigger handle is on the left.

o. Secure the handle to the breech block with the four breech handle assembly screws.

p. Replace tools in breech handle and replace breech handle cap.

q. Test by cocking the piece and actuating the firing mechanism.

SECTION III

MECHANICAL FUNCTIONING

6. GENERAL.—*a. Scope.*—A gun crew, to be efficient, must be able to keep its gun in action during combat. This weapon has one characteristic in common with all other weapons in that it is subject to stoppages. Therefore, in order to recognize the causes of mechanical failures and to reduce the stoppages resulting therefrom, the crew must have a working knowledge of mechanical functioning. For purposes of instruction the subject of functioning is divided into three main headings which are:

(1) Opening the breech.
(2) Closing the breech.
(3) Firing the piece.

b. To unload.—The gunner opens the breech by rotating the breech block clockwise (using the trigger handle only) through an angle of approximately forty five degrees, and then withdraws the breech assembly from the chamber. The loader grasps the extracted, expended round by hand and ejects it.

c. To load.—The loader inserts a round of ammunition into the chamber engaging the pre-engraved rotating band with the lands and grooves of the tube. The loader replaces the breech block in the chamber and rotates it (using the breech handle only) counterclockwise to the locked position.

d. To fire the piece.—The gunner rotates the safety counterclockwise (using either the index or middle finger of the right hand) as far as it will go, and then depresses the trigger with his thumb.

e. To clear the gun.—The gunner opens the breech; the loader checks the chamber to see that the piece is unloaded. The piece is clear as long as the breech is open and the chamber is empty.

7. FUNCTIONING.—Since functioning is a cycle, it is necessary to choose some point in the cycle from which to start. In the paragraphs on functioning which follow it is assumed that the piece has just been fired and that the empty shell case is still in the chamber. With this situation existing, successive steps in operation of the piece are:

a. Opening the breech.—(1) *Cocking.*—The cam rollers in the hammer housing hold the hammer so that when the breech handle assembly is rotated, the hammer must also rotate. The hammer is free to move horizontally back and forth independently of the breech handle assembly. When the breech handle assembly is properly positioned against the breech block, the cam rollers in the hinge are lined up with the square slots in the hammer. When the breech handle assembly is rotated clockwise, the cocking cams on the hammer come into contact with the cam rollers in the hinge, and since these are immovable, the hammer is forced to the rear against the action of the firing spring. When the hammer has been cammed to the rear approximately one half inch, the sear notch has moved into position so that the sear can be cammed to the right by the camming action of the oblique hole in the base of the trigger against the bent end of the sear. This camming action is actuated by the trigger spring which has a tendency to draw the base of the trigger up. The sear then enters the sear notch, and engages the hammer in the cocked position. When the breech block has been rotated clockwise through approximately forty five degrees, the piece has been cocked.

(2) *Unlocking.*—When the breech block has rotated clockwise through approximately forty five degrees, the interrupted screws on the breech block become disengaged or unscrewed from their locking surfaces in the chamber, and the breech is unlocked. Rotation is stopped when the right arm of the breech handle assembly comes in contact

with the built up portion of the hinge. (Note: There are two unlocking actions. One is as described in sub-paragraph (2) above; the other refers to the disengaging of the breech lock from the hinge as in sub-paragraph *c* (1) below).

(3) *Extraction.*—When the breech block is in the closed and locked position the hook of the extractor is positioned in front of the rim of the cartridge case, and held in that position by its own spring. When the breech block is withdrawn from the chamber the extractor hook remains engaged with the rim of the cartridge case until the extractor is swung out of position downward and to the rear, or until the case has been extracted from the chamber for a distance of about two inches.

(4) *Breech block stop.*—The action of stopping the breech block so that it may not be rotated while in the open position, is performed by the extractor arm. When the breech is open the extractor arm is forced into a recess in the rear of the breech block by the action of the extractor spring, thereby locking the breech block to the hinge. The purpose of this action is to insure that when the breech block is placed into the chamber the threads on the breech block will not burr against their locking surfaces in the chamber.

b. Closing the breech.—(1) *Action of the breech block stop.*—When the breech block is closed the hook of the extractor first comes into contact with the rim of the shell case, or with the choke ring if the piece is not loaded, and is cammed away from the center of the breech block against the action of the extractor spring. This camming action forces the arm of the extractor out of the recess in the rear of the breech block, and thereby breaks the connection between the breech block and the hinge, so that the breech block is free to be rotated counterclockwise to the locked position.

(2) *Action of the extractor.*—When the breech block is fitted into the chamber, the extractor hook comes in contact with the rim of the shell case and is cammed to the

side of the case momentarily. When the breech block is fully seated the extractor hook snaps into position to extract the expended case when the breech is reopened.

(3) *Locking.*—When the breech is rotated counterclockwise the interrupted screws on the breech block engage with their locking surfaces in the chamber. When this rotation is complete the cut away portion of the breech lock cam on the hammer is in position to receive the small end of the breech lock. The small end of the breech lock is then forced into the cut away portion of the breech lock cam by the breech lock spring. When the breech lock is in this position, the shoulder of the lock bridges the gap between the breech handle assembly and the hinge thereby preventing rotation of the breech block. The breech can be unlocked without actuating the firing mechanism by moving the breech lock pin to the right.

c. Firing the piece.—(1) *Action of the firing mechanism.*—The safety is a sleeve with slots in it. The slots are so arranged that the rotation of the safety aligns the longitudinal slot with the trigger key so that the trigger may be depressed. As the trigger is depressed, the oblique hole (sear recess) in the base of the trigger acts as a cam against the bent end of the sear, camming the sear away from the hammer. As the sear becomes disengaged from the sear notch in the hammer, the hammer firing pin assembly moves forward under the action of the firing spring. (Rotation of the safety puts a tension on the trigger spring which tends to return the safety to its original position. Depression of the trigger also puts a tension on the trigger spring which tends to return the trigger to its original position. When the trigger is drawn up to the firing position the sear is cammed to the right. The trigger and safety do not return to their firing position until the piece is recocked because the sear cannot be cammed to the firing position unless the sear notch is in position to receive the tapered end of the sear). As the hammer goes forward the breech lock cam on the hammer cams the breech lock to the right, disengaging the shoulder of the breech lock from its recess in the breech block, thus unlocking the block so that it is

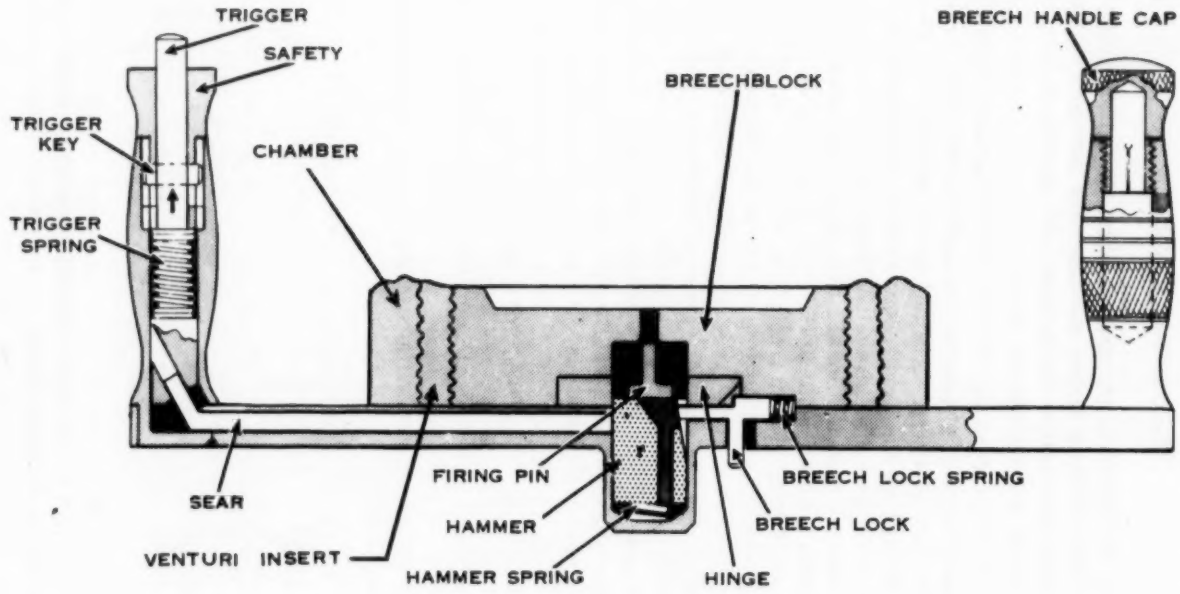


FIGURE 19.—Cross Section of Breech Block.

free to be rotated to the open position. The firing spring drives the hammer firing pin assembly forward so that the firing pin strikes the primer with sufficient force to detonate it, and the piece is fired.

(2) *Action of gases.*—When the propellant charge is detonated a chemical reaction transforms the solid powder into a mass of hot gases which either ruptures or burns its way through the Kraft paper container within the shell case and escapes through the perforations. The gases have a tendency to expand in all directions with equal force. The force exerted against the restricted openings in the breech end cause enough recoil force to balance the forward thrust caused by the friction of the projectile against the walls of the tube. The gas escape orifices in the breech are canted so that the gases are given a twisting motion to the rear. The resulting rotational thrust on the tube is equal and opposite to the rotational thrust caused by the projectile spinning through the tube. The piece therefore remains motionless when fired.

SECTION IV

STOPPAGES AND IMMEDIATE ACTION

8. DEFINITIONS.—*a.* A stoppage is any unintentional cessation of fire.

b. Immediate action is the unhesitating procedure used for the prompt reduction of usual stoppages.

9. STOPPAGES.—*a. Prevention of stoppages.*—With a knowledge of functioning and care and cleaning, the gunner can eliminate stoppages, to a large extent, by taking proper care of his piece and by performing detailed inspections from time to time. Prevention is the best remedy for all stoppages.

b. Causes for stoppages.—Listed below are common stoppages and their usual causes.

(1) Failure to fire:
  (a) Defective ammunition.
  (b) Broken firing pin.
  (c) Weak or broken firing spring.
  (d) Carbon on firing pin shoulders.
  (e) Carbon in firing pin recess.
  (f) Breech not fully locked.
  (g) Trigger frozen.

(2) Failure to cock:
  (a) Weak, broken, or disconnected trigger spring.
  (b) Broken sear.
  (c) Hammer assembled incorrectly.
  (d) Insufficient rotation of breechblock.
  (e) Cam rollers not replaced.

(3) Failure of breech to open:
  (a) Breech lock engaged with hinge. (Piece not fired.)
  (b) Incomplete rotation of breechblock.

(4) Failure to extract:
  (a) Broken or missing extractor spring.
  (b) Broken extractor hook.
  (c) Extractor frozen in position.

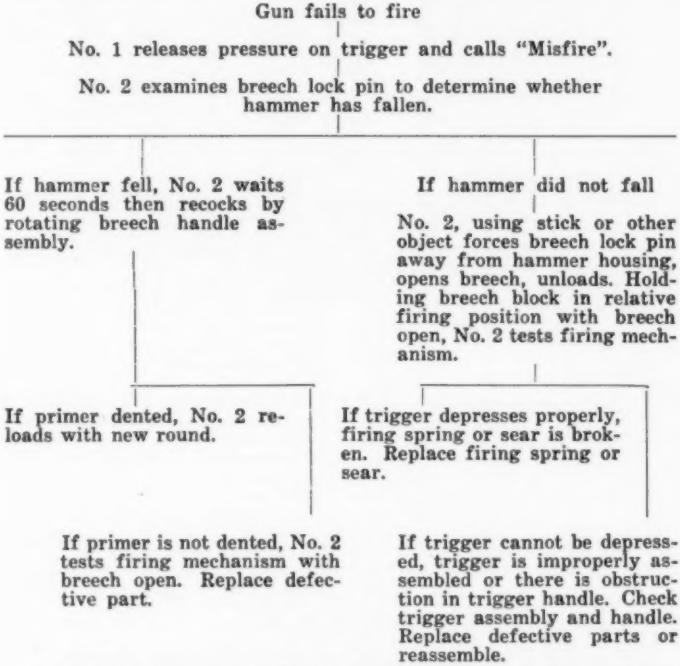
(5) Failure of breech to close and lock:
  (a) Broken or missing extractor spring allowing premature rotation of breechblock.
  (b) Extractor frozen in position allowing premature rotation of breechblock.
  (c) Bent or improperly positioned extractor. (Extractor not aligned with extractor clearance cut.)
  (d) Pre-engraved rotating band burred causing improper positioning of round in chamber.
  (e) Fouling in throat of tube causing improper positioning of round in chamber.
  (f) Fouling of breechblock threads or locking surfaces.
  (g) Misalignment of threads because of shifted hinge block.

c. Common malfunctions of operation.—Although not considered stoppages in the literal sense of the word, the gunner should be familiar with these two common malfunctions.

(1) Recoil when fired—obstruction in gas escape orifices.

(2) Forward movement when fired—gas escape orifices too large. (To be corrected by ordnance maintenance personnel only.)

10. REDUCTION OF STOPPAGES.—*a. Immediate action.*


Gun fails to fire
No. 1 releases pressure on trigger and calls "Misfire".
No. 2 examines breech lock pin to determine whether hammer has fallen.
If hammer fell, No. 2 waits 60 seconds then recocks by rotating breech handle assembly.
If primer dented, No. 2 reloads with new round.
If primer is not dented, No. 2 tests firing mechanism with breech open. Replace defective part.
If hammer did not fall
No. 2, using stick or other object forces breech lock pin away from hammer housing, opens breech, unloads. Holding breech block in relative firing position with breech open, No. 2 tests firing mechanism.
If trigger depresses properly, firing spring or sear is broken. Replace firing spring or sear.
If trigger cannot be depressed, trigger is improperly assembled or there is obstruction in trigger handle. Check trigger assembly and handle. Replace defective parts or reassemble.

b. Other stoppages.—If the procedure outlined in *a* above does not place the gun in action, the gunner must inspect the working parts of the gun to locate and reduce the stoppage. Table following lists less common stoppages and actions by which the stoppages can be reduced.

Stoppage	*Indication*	*Action*
Gun fails to cock.	Breech lock pin remains in unlocked position.	No. 2 attempts to recock making sure breech handle assembly is rotated clockwise as far as it will go.
Gun still fails to cock.	Breech lock pin remains in unlocked position.	No. 2 removes breech handle assembly and checks assembly of hammer, checks cam rollers, sear, and trigger spring. Replaces or reassembles defective part.
Breech fails to open.	Breech fails to open.	No. 2 calls for No. 1 to remove hand from trigger handle. No. 2 then checks breech lock pin. If hammer has not fallen he proceeds as in par. 10*a* above. If hammer has fallen No. 2 checks to see if breech handle assembly has turned far enough to disengage breech block screws from locking surfaces in chamber.
Gun fails to extract.	No. 2 cannot grasp empty shell case.	No. 2 examines extractor hook, tests the extractor for freedom of movement, strength of spring; replaces defective part or cleans out foreign matter.
Breech fails to close and lock.	Breech fails to close and lock.	No. 2 checks breech block for premature rotation: checks extractor for freedom of movement, checks to see if extractor is aligned with extractor clearance cut: corrects extractor deficiencies by replacement or reassembly. If extractor is correct No. 2 checks to see that ammunition is seated properly; checks fouling in throat of tube and on threads of breech block and locking surfaces; cleans out fouling. If there is no fouling, No. 2 checks hinge block for proper position: if shifted, gun must be repaired by higher echelon.
Malfunctions: Gun recoils when fired.	Gun recoils when fired.	No. 2 removes obstruction from gas escape orifices.
Gun moves forward when fired.	Gun moves forward when fired.	Venturi insert must be replaced by ordnance maintenance personnel.

SECTION V
AMMUNITION AND FUZES

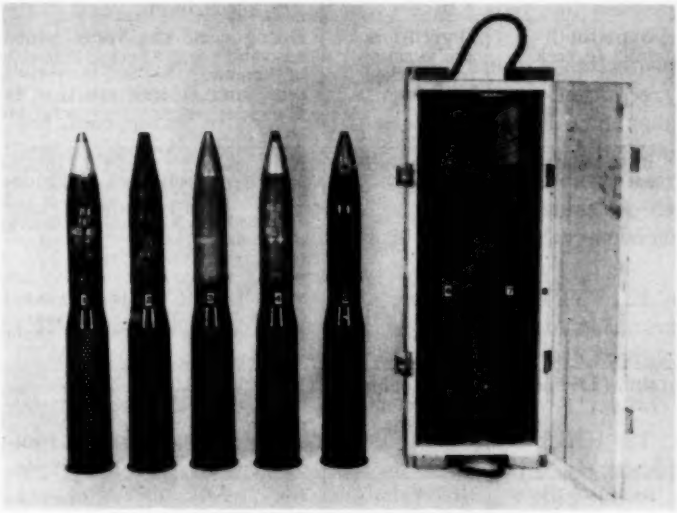


FIGURE 20.—Ammunition and Containers for 75-mm Rifle M-20.

1. High explosive
2. High explosive antitank
3. White phosphorus
4. Target practice
5. Inert
6. Individual hermetically sealed container
7. Individual fibre container (fits in metal container)
8. Packing crate containing two rounds in individual containers

11. GENERAL.—Ammunition for the 75-mm Rifle M-20 is issued in the form of complete, fixed rounds (figure 20). The round consists of a primer and propelling charge in a perforated case. (The term "fixed" used in connection with ammunition signifies that the propelling charge is not adjustable and that the round is loaded into the weapon as a unit.) The case is crimped rigidly to the projectile because the round must be rotated in the chamber so that the pre-engraved rotating band can be fitted into the lands and grooves of the tube. Because of the pre-engraving on the

rotating band, a lower chamber pressure is required to propel the round. The propellant is contained within the casing by a thin tube of Kraft paper. This paper is only 0.004" thick, so caution must be observed in handling the round to prevent this paper tube from becoming broken, permitting the propelling charge to spill. Because of the incomplete protection against moisture afforded by the paper, added precautions must be taken to assure that the ammunition is kept dry. Each round comes packed in a waterproof, hermetically sealed container and should not be unpacked until ready for use. Each round weighs 23 pounds; in its individual container it weighs 27 pounds. Two rounds in their wooden crate weigh 78-80 pounds.

12. TYPES.—Dependent upon the type of projectile, ammunition for this rifle is classified as high explosive (HE), high explosive antitank (HEAT), white phosphorus (WP), inert (IN), and target practice (TP).

13. HIGH EXPLOSIVE.—The HE projectile is a comparatively thin walled projectile containing a high explosive bursting charge. It is used principally for fragmentation or mining effects. It has a total weight of 14.4 pounds and contains a charge of 1.4 pounds of TNT. It comes equipped with a point detonating (PD)-M48A2 or M51A4 fuze (figure 21), either of which may be set for instantaneous (SQ) or delayed detonation. (Note: The only difference between the two fuzes is the booster charge). Settings are made by turning a setting screw in the side of the fuze. Setting positions marked "DELAY" and "SQ" (super quick) are stamped on the side of the fuze ogive (F). The setting device is an eccentrically positioned plunger (J) and plunger spring (K) the functioning of which is regulated by a setting sleeve (I). The head of the sleeve is slotted to facilitate turning when adjusting the setting. When the slot in the sleeve head is aligned with the "SQ" line, the sleeve, which is thicker on one side than on the other, is turned so that it does not interfere with movement of the

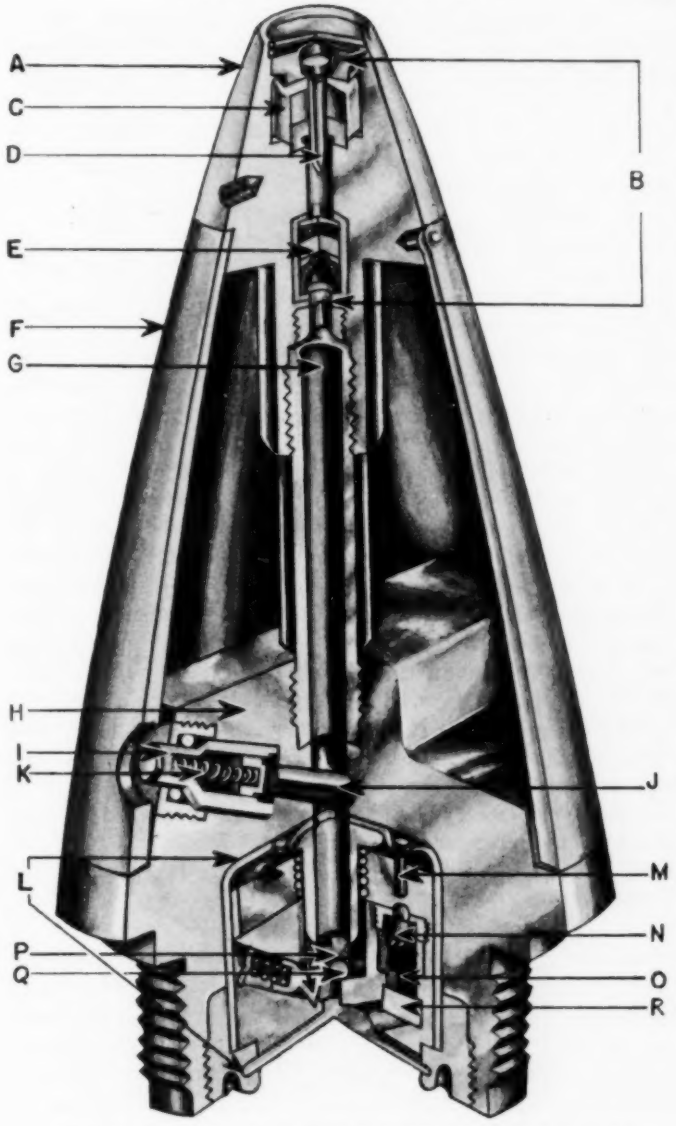


FIGURE 21.—Fuze PD M48A2 and M51A4 for HE Round.

plunger. The plunger is free, therefore, to move outward under centrifugal force, and thereby open the passage (G) from the head of the fuze to the booster charge. Super quick detonation occurs when the nose of the fuze strikes an object. The head of the fuze (A) is crushed and the firing pin (D), which is supported by a gilding metal cup (C), is driven into the detonator (E) setting it off. The flash from the detonator passes down the tube (G), which connects the super quick action (B) to the body (H), and into the booster. When the slot in the setting sleeve is aligned with the "DELAY" line the thick side of the sleeve is in position to stop any outward movement of the plunger, and, even though the super quick action functions normally on impact, the detonator flash never gets past the plunger into the booster. On impact the delay action (L) comes into play. Centrifugal force causes the plunger pins (Q) to recede outward, thereby leaving the delay action mechanism free to move forward. Centrifugal force also causes the plunger pin lock (P) to place an arm against the inner end of each plunger pin so that the pins are prevented from returning to the unarmed position. On impact, inertia causes the delay action plunger to move forward driving the primer (N) against the firing pin (M). The primer ignites the black powder delay pellet (O) which in turn detonates the relay charge (R). No action takes place upon firing until sufficient rotational speed has been established to overcome the resistance of springs and set back force on the safety devices. Bore-safe super-quick action is provided by the plunger (J). Bore-safe delay action is provided by the M20 booster, for the M48A2 fuze and by the M21A2 booster for the M51A4 fuze.

14. HEAT.—The armor penetrating ability of a normal projectile depends upon its weight, the velocity at time of impact, and angle of strike. Since muzzle velocities have been greatly reduced in this weapon it is necessary to employ a shaped or hollow charge in order to secure armor penetration. The HEAT projectile employs such a charge.

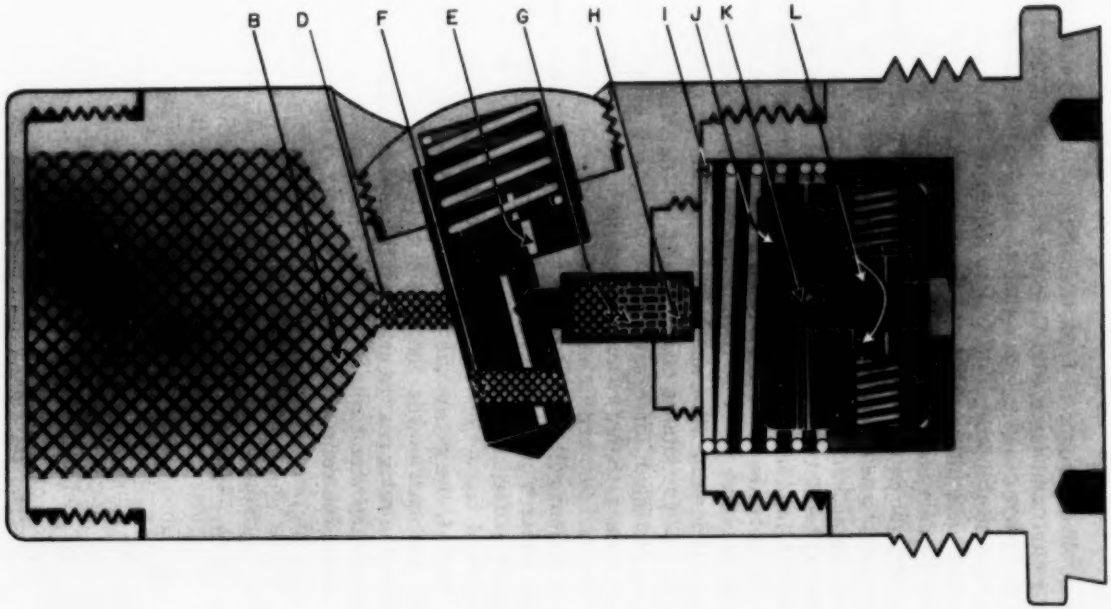


FIGURE 22.—Fuze BD M62A1 for HEAT Round.

The projectile weighs 13.1 pounds and is capable of penetrating approximately four and one half inches of homogeneous armor plate. It contains about two pounds of a mixture of pentolite and TNT. The fuze for the projectile is the base detonating (BD) M62A1 (figure 22) for which there is no delay setting. The firing pin (K) is held in the unarmed position in the percussion plunger by spring held safety pins (L) which release the firing pin under the action of centrifugal force. The percussion plunger assembly will not arm at 1,700 revolutions or less per minute. The slider assembly (E) is normally positioned under spring pressure in its recess in the fuze body so that the slider charge of the slider is out of alignment with the other explosive elements. When sufficient centrifugal force has been set up, the slider overcomes the resistance of the spring and moves outward, bringing the slider charge (F) into alignment. The slider will not arm at 2,400 revolutions or less per minute, but must arm at 3,600 revolutions per minute. Upon firing and after sufficient rotational force has been created, the firing pin and slider move into the armed position. However the percussion plunger assembly (J) is held to the rear during the flight of the projectile by the restraining spring (I). Upon impact, the plunger overcomes the resistance of the springs and carries the firing pin forward against the primer (H), initiating the action of the explosive train (G) through the booster lead (D). The booster pellet (B) in its turn causes detonation of the shell bursting charge.

15. WP.—The white phosphorus projectile (wt. 15.1 pounds) is used for producing a screening smoke, an incendiary action, anti-personnel action, or any combination of these. The filler is white phosphorus. The projectile has a thin wall, tubular casing called the burster, which extends nearly the length of the filler cavity, and which contains a detonator relay chain and a burster charge of high explosive to rupture the shell and disperse the chemical contents. The fuze M57 (figure 23) is essentially the M48A2 fuze modified to a single action superquick type by omitting the delay element, and is of the same size, shape, and weight. There is no setting sleeve on the centrifugal interrupter.

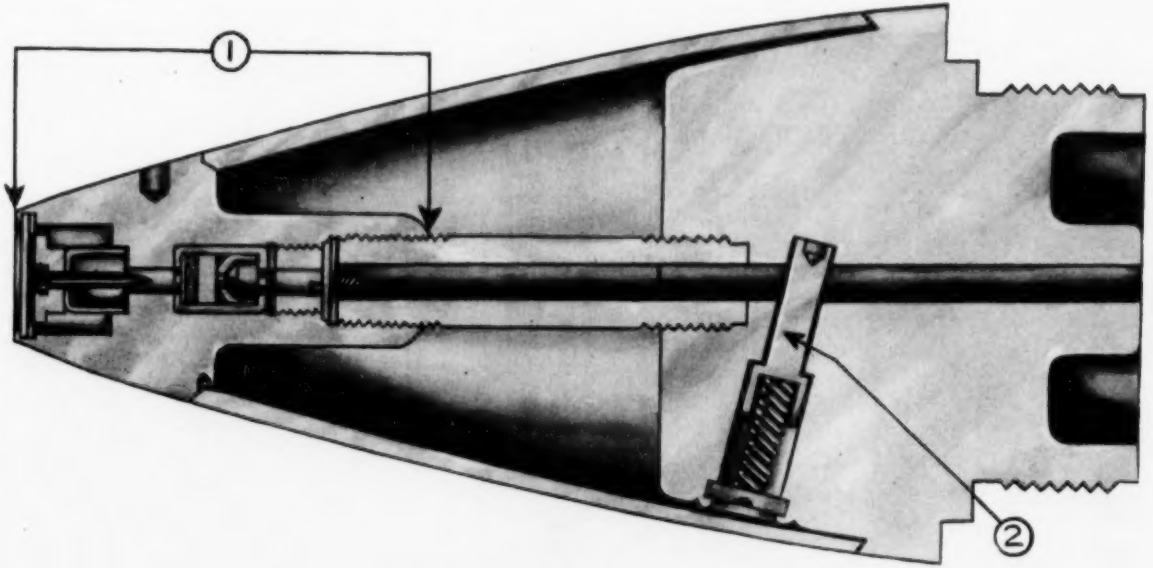


FIGURE 23.—Fuze PD M57 for WP Round.

1. Superquick elements
2. Centrifugal interruptor

16. TP.—The target practice projectile weighs 14.4 pounds. It is made of cast iron and has the same dimensions, weight, and center of gravity as the HE projectile. It contains a black powder spotting charge and is equipped with the M51A4 fuze (figure 21).

17. IN.—The inert projectile contains no explosive charge. It is plastic loaded to bring it up to the weight of the HE projectile (14.4 pounds). It is equipped with the dummy fuze M73.

SECTION VI

CARE AND CLEANING

18. GENERAL CARE.—*a.* Dirt and grit, accumulated in traveling or from blast of the piece in firing, form cutting compounds. Powder fouling settles between and on operating parts and attracts moisture, prevents proper operation of moving parts, and hastens the formation of rust. Dirt, grit, and powder fouling should be cleaned from all parts at frequent intervals, depending upon use and service.

b. If rust should accumulate, its removal from bearing surfaces requires special care in order that clearances should not be unduly increased. Crocus cloth should be used for this purpose. *The use of coarse abrasives is strictly forbidden.*

c. When the weapons are not in use they should be properly oiled and covered.

19. PREVENTIVE MAINTENANCE SCHEDULES.—*a. Before firing.*—(1) Remove and disassemble the breech block group and wipe all components thoroughly dry.

(2) Thoroughly clean the bore and chamber of all dirt and oil.

(3) Assemble the gun and wipe outer surfaces with a clean, dry rag.

b. After firing.—The procedures outlined below are to be followed immediately after firing and are to be repeated each day for three consecutive days, or until there is no

longer an evidence of sweating. The materials and cleaning and preserving procedures will be used for recoilless weapons' bores in order of preference indicated below.

(1) *Rifle bore cleaner.*—(a) Thoroughly clean the bore with rifle bore cleaner each day for two days after firing making sure that all surfaces including the rifling are well coated. Do not wipe dry.

(b) On the third day after firing, clean the bore with rifle bore cleaner. If the piece will probably be fired within the next twenty-four hours, do not wipe dry until just before firing. If the piece will not be fired within the next twenty-four hours, wipe dry and coat with the prescribed oil. (Note: the bore should not be cleaned with bore cleaner until the tube has cooled to the point where it can be touched with the bare hand. Bore cleaner is an excellent rust preventive for periods of from twenty-four to forty-eight hours.)

(c) After the third day since firing, renew the oil film daily. Every fifth day, clean with rifle bore cleaner, wipe dry, and oil.

(2) *Soda ash.*—(a) Prepare a solution of one-half pound soda ash to each gallon of warm water. In temperatures below 32° F, and if the tube to be cleaned is cold, add the type and amount of antifreeze prescribed in TM 9-850.

(b) Immediately after firing and on three consecutive days thereafter, thoroughly clean the bore with the soda ash solution. Rinse with clear warm water and wipe dry. Coat with the prescribed oil.

(c) When the piece is not being fired, renew the oil film daily. Every fifth day, clean the bore with dry-cleaning solvent, wipe dry, and reoil.

(3) *Soap.*—(a) Use castile or issue soap. Prepare a sponging solution by shaving one pound of soap into four gallons of water. If possible, warm the water to facilitate dissolving the soap. In temperatures below 32° F, and if the tube to be cleaned is cold, add the type and amount of antifreeze prescribed in TM 9-850.

(b) Follow the same cleaning, drying, and oiling procedure prescribed for soda ash solution. (Caution: when issue soap is used, the bore must be thoroughly rinsed after cleaning as the soap may contain a free caustic which will cause corrosion if not completely removed.)

(4) *Hot water.*—(a) As a temporary measure after firing, the bore may be cleaned while still hot by swabbing with quantities of hot water. This method will be used only when rifle bore cleaner, soda ash, or soap is not available. Extreme care must be taken to thoroughly dry the bore after cleaning with hot water. A coating of oil will be applied immediately thereafter to prevent rust.

(b) Swabbing with hot water may not remove all of the primer salts or powder residue. It is most important, therefore, that the bore be cleaned as soon as possible in accordance with subparagraph (1), (2), or (3) above.

c. The chamber.—The method and materials used for cleaning the bore will be used for cleaning the chamber, however, the bore brush is impractical for cleaning the chamber and an improvised burlap swab on a stick should be used.

d. The breech.—The breech mechanism must be disassembled, all parts cleaned and oiled, and reassembled at each cleaning. Rifle bore cleaner, preferably, or dry-cleaning solvent will be used to clean the parts.

e. Oiling.—For temperatures above 32° F, engine oil SAE 30 should be used for oiling all parts; for temperatures between 0° and 32° F, SAE 10; for temperatures below 0° F, preservative lubricating oil.

SECTION VII

MOUNTINGS

20. TRIPOD M1917A1.—The 75-mm Rifle M20 was designed to be mounted on the Browning machine gun tripod M1917A1, for description of which see Section VI, Chapter 1, FM 23-55. Two mounting brackets are assembled on the piece. The rear mounting bracket is at the junction of the

tube and chamber. The front mounting bracket is a circular removable bracket which is clamped and tightened on the tube by means of screws. Position of the front mounting bracket can be adjusted so as to fit the mounting brackets of the gun to the tripod. The gun pintle is attached to the rear mounting bracket, and the frame mounting bracket fits over the elevating screw head. The gun is mounted on the tripod with the trail leg and longer arm of the cradle to the front. (See figure 17.)

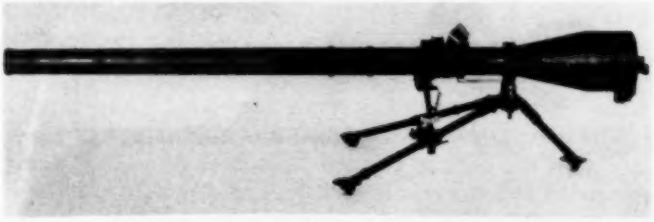


FIGURE 24.—75-mm Rifle Mounted on M2 Tripod.

21. OTHER MOUNTINGS.—The gun may be mounted on any mount that will take a pintle. Successful and efficient firing has been acomplished with the gun mounted on the light machine gun tripod M2 (figure 24) and on the pedestal and dashboard mounts (figure 25) of the ¼-ton truck. When firing from the ¼-ton truck, care must be taken that the back blast does not damage any part of the vehicle.

FIGURE 25.—75-mm Rifle on Dash Mount of ¼-ton truck.

SECTION VIII
SIGHTS AND BORE SIGHTNG

22. GENERAL.—Since the 75-mm Rifle M20 is capable of delivering both direct and indirect fire, it is equipped with two sights. The telescope sight M85C is used for direct fire for ranges up to and including 2,100 yards. (The sight reticle is not graduated above 2,100 yards.) The telescope sight is used for direct fire for ranges over 2,100 yards and for all indirect fire.

FIGURE 26.—Sight M85c for 75-mm Rifle.

23. SIGHT M85C.—The sight M85C is a short tube-type telescope provided with a sun shade and rubber eye shield. The telescope is a fixed focus, three-power instrument having a field view of 11 degrees 30 minutes. The reticle pattern consists of a series of broken horizontal lines and a broken vertical line. The cross hair at the top of the pattern represents zero deflection and zero elevation. Each vertical line segment and each space between the segments represents a change in range of one hundred yards. Each horizontal line segment and each space between the segments represents an angular lead of five mils. The number 7676064 at the top of the reticle identifies the part. The notation 75-HEAT T39 identifies the type of ammunition used in

making the sight reticle. There is a dovetail slot with a window on the side of the telescope to which the night lighting device may be fixed.

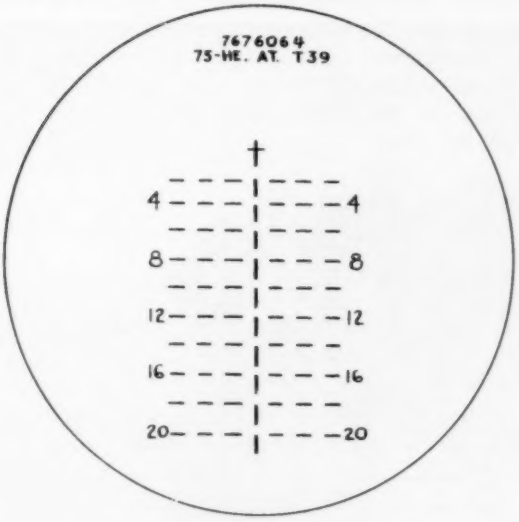


FIGURE 27.—Sight Reticle, Sight M85c.

24. SIGHT E19.—*a*. The sight E19 (figure 28) consists essentially of three parts. The lower part is the elevation quadrant T13E1 which furnishes the means for laying the piece in elevation. Rotating the elevation knob elevates or depresses the line of site. The amount of elevation is registered in mils on a scale and micrometer. The elevation scale is graduated in one hundred mil increments from minus 200 to plus 1,600, every second graduation being numbered. The elevation micrometer is graduated in two mil increments from 0 to 100 mils, every fifth graduation being numbered. The centralizing of the longitudinal bubble determines when the rifle is elevated to the height indicated on the scale.

b. The telescope adapter M-9 is the center part of the sight. It contains the mechanism and scales for laying the piece in direction. It has an azimuth scale which is gradu-

ated in 100 mil increments in two semi-circles from 0 to 3,200 mils each. Every fourth graduation is numbered. The deflection micrometer is graduated from 0 to 100 mils in one mil increments, each tenth graduation being numbered.

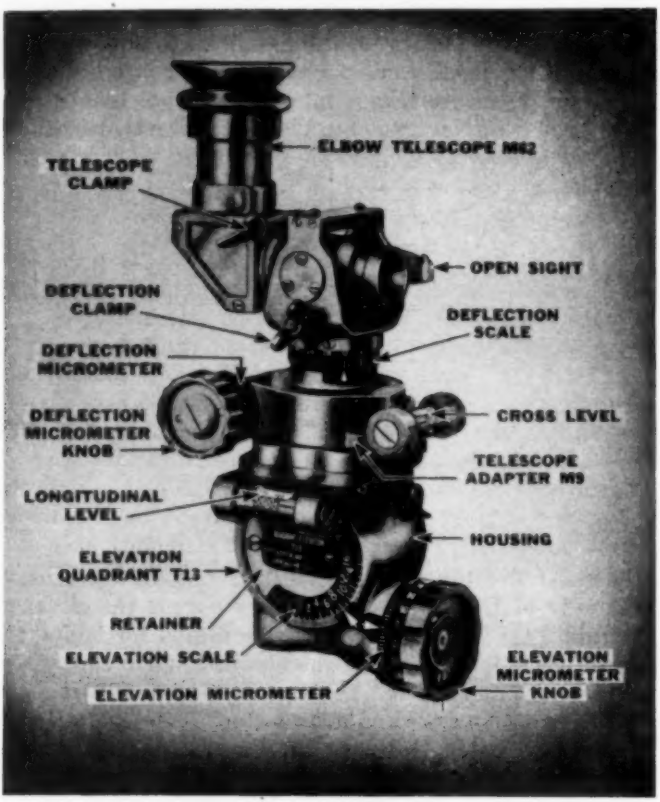


FIGURE 28.—Sight E19.

Azimuth or deflection is set on the scale and micrometer by turning the azimuth worm knob. For rapid motion in azimuth, the internal worm and worm gear can be disengaged by pushing outward on the azimuth worm knob. The worm gear can then be re-engaged to make a finer setting. The adapter also contains the cross level bubble.

c. The top part of the sight is the elbow telescope M-62, which is a three power, fixed focus instrument having a field view of 12 degrees, 12 minutes. The reticle pattern consists of a vertical and horizontal line which cross at the reticle center. The telescope is attached to the adapter in such a manner that, by loosening the elevation clamping screw, the telescope can be elevated, or depressed independently of the elevating mechanism; and by loosening the telescope clamping screw, the telescope can be rotated about the axis of the horizontal arm of the scope. A dovetail bracket, housing a window on the side of the telescope provides for attaching the night lighting device.

25. BORE SIGHTING.—*a. Sight M85C.*—To bore sight the rifle with this sight it is necessary to make the axis of the bore (extended), intersect the line of site at some distant point, preferably a point beyond the range to any likely target. On the muzzle end of the gun, there are four notches ninety degrees apart. If threads are stretched across alternate notches, the intersection of the threads defines the axis of the bore at the muzzle end. If the breech handle assembly is removed from the breechblock, the firing pin aperture defines the axis of the bore at the breech end when the breech is closed. (The cut off base of an empty shell case with the primer punched out can be inserted into the choke ring, and the primer aperture used in place of the firing pin aperture.) By means of elevating and traversing the piece, the axis of the bore can then be aimed at the aiming point. To place the reticle cross on the same aiming point it is necessary to loosen the elevation and deflection worm locking nuts. When these are loose the elevation and deflection worms on the telescope mount can be turned with a screw driver to adjust the position of the reticle cross with respect to the aiming point. When the reticle cross and the axis of the bore are on the same aiming point the piece is bore sighted.

b. Sight E19.—(1) *Adjustment of the elevation quadrant.*—If the elevation quadrant is in adjustment, the tube will be elevated to the number of mils indicated on the elevation scale and micrometer when the longitudinal bubble

is leveled. To test the adjustment, set the scale and micrometer of the gunners quadrant to zero, place the quadrant on the gun and by means of the elevating mechanism on the gun, level the bubble on the gunner's quadrant. Level the longitudinal bubble on the elevation quadrant of sight E19 by means of the elevation micrometer knob on the sight. The elevation and micrometer scales should then read zero. If they do not they must be made to read zero as follows: loosen the screw in each end of the scale and shift the scale until it reads zero; tighten the screw; loosen the three small screws in the end of the elevating knob and while holding the knob to prevent it from moving, shift the micrometer scale to read zero; tighten the screws. Check the settings with the level bubble to make sure that the elevation micrometer knob did not turn when the screws were being tightened.

(2) *Adjustment of cross level.*—If adjustment of the cross level is necessary, notify ordnance personnel to make correction.

(3) *Adjustment of deflection scale and micrometer.*

(a) Aim the axis of the bore at an aiming point.

(b) Observing through the telescope and, using the azimuth worm knob, bring the vertical cross-line on the reticle to bear exactly on the aiming point. The azimuth scale and micrometer should then read zero. If they do not, they must be made to read zero as follows: loosen the four screws in the clamping ring and slip the scale until it reads zero; tighten the screws; loosen the large clamping nut in the end of the micrometer knob and, while holding the knob to prevent it from turning, slip the micrometer scale to read zero; tighten the clamping nut. Check the readings and the alignment on the target to see that the knob did not turn while the clamping nut was being tightened.

(4) If it is desired to use the elbow telescope for direct fire, the line of site must also be adjusted for vertical parallelism. To make this adjustment, loosen the elevating clamping nut and elevate or depress the telescope until the horizontal cross-line on the reticle falls on the aiming point.

CHAPTER 3

Sound Locating Set GR-6

Sound locating set, GR-6, is one of the newest pieces of equipment to be added to the TO & E of the Infantry regiment. It was designed and developed as an auxiliary means of locating enemy weapons such as machine guns, mortars and light and heavy field artillery pieces. As is the case with any technical equipment, a number of years was spent designing, developing, and building experimental models from service tests. After this, more time was consumed getting the equipment into production by commercial firms. Therefore it was not until early 1945, during the latter phases of World War II, that it was presented to the Service as equipment that would successfully locate, by sound alone, hostile weapons that could not be located by visual means.

The sound locating set operates on the theory of sound ranging which is the term applied to the procedure of locating the source of a sound. For example, when a weapon is discharged, sound waves are set up and propagated uniformly in all directions away from their source in the form of concentric circles. This action may be compared to the action caused when a pebble is dropped into a pond of still water. Upon contact with the surface of the water, the pebble sets up a series of concentric waves or ripples. Readings are taken and calculations are made on these sound waves by two identical directions finding units or teams operating at the extremities of a predetermined base line and by a geometric process, the source of the sound is determined.

When enemy weapons may be detected visually by their flash, smoke, or movement of enemy personnel, it is obvious that spotting or locating may be more quickly accomplished by visual means than by any known method of

sound ranging. However, there will be few instances when the enemy weapons may be detected visually because of intervening terrain features, smoke, fog, darkness, etc. In these cases the sound locating set may be used to good advantage.

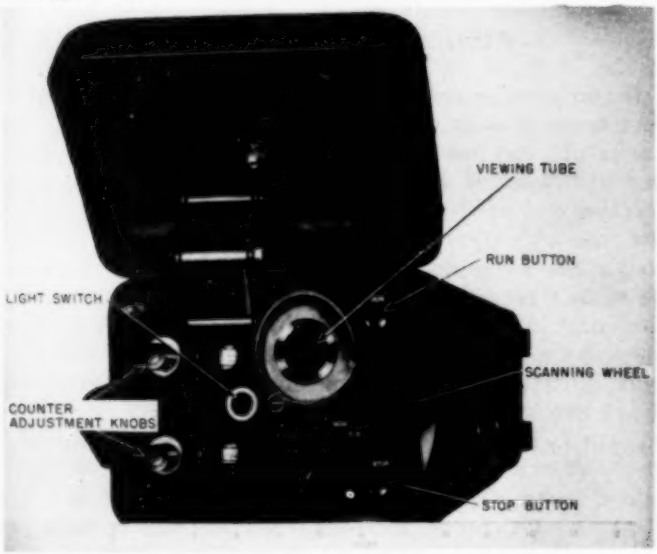


FIGURE 29.—Recorder, Sound Locating Set GR-6.

When the sound locating set, GR-6 became available to the Service in the early part of 1945, it was directed that fifty squads to operate the sets be trained at Fort Benning, Georgia. Upon completion of training these squads were to be sent to overseas theaters to combat-test the equipment before putting it into full-scale production. The first five of these squads, after an intensive ten-day period of training out of a proposed four-week schedule, were suddenly sent to the Pacific Theater and they arrived in time to participate in the Okinawa Campaign. In spite of their short period of training these five squads gave an excellent account of themselves. Operational reports from Tenth Army Headquarters and Headquarters, XXIV Corps, indicate the

equipment to be of definite value and very effective even under most severe atmospheric conditions and terrain difficulties.

Unfortunately, the commanders of the units to which these squads were assigned had very little or no knowledge of the equipment and its capabilities. As a result they were reluctant, at times, to place counterfire on targets located by the GR-6. As one officer from the 17th Infantry stated: "We are now convinced when the sound locating team says a gun is at a certain location that it is really there. Last night, the team reported a 75-mm gun just 300 yards in front of our lines. The data was given to the artillery but they did not believe such a gun would be that close to our lines. The team leader called me at the time and said that a gun was there but no fire was placed on the designated location. When our troops advanced this morning, they recieved point blank fire from a gun whose position checked with the location given by the team last night. A tank knocked out the gun. Hereafter, we will fire at all targets given us by the team." Consequently, even though the equipment has proved to be effective and worthwhile, it is felt that its maximum effectiveness has not yet been ascertained because of this natural reaction of unit commanders.

As a result of combat tests, it was decided to make the sound locating set an integral part of the Infantry regiment. TO & E 7-12 dated 1 June 45 sets up a regimental counterfire section composed of a section headquarters and three battalion counterfire squads of six men each. Section headquarters includes one captain, who, in addition to being the assistant S-3, is also the regimental counterfire officer and a technician 4th grade who is a GR-6 repairman. The counterfire officer is directly responsible for the three battalion counterfire squads. The repairman is responsible that the GR-6 equipment is in operating condition and batteries used as power supply are charged.

Each battalion counterfire squad is composed of two identical teams. These two teams are the two direction finding teams previously mentioned that operate at the extremities of the predetermined base line. Each team has an

operator, one a staff sergeant, squad leader, and the other a sergeant, assistant squad leader. The operators obtain numerical data from the recorder which is the basic component of the equipment. No calculations are necessary on the part of the operator to obtain this data which is passed on to a computer who is a technician 5th grade. The computer, through the use of a circular gridded disc called a computer, converts the numerical data into a magnetic azimuth and gives it to a plotter who is a private or a private first class. Plotting is done on an M-10 plotting board or on graph paper. The plotter marks off the azimuth from his team position and the azimuth obtained by the other team from their position. The projection of the two azimuths results in an intersection which is the target location. (See figure 30.)

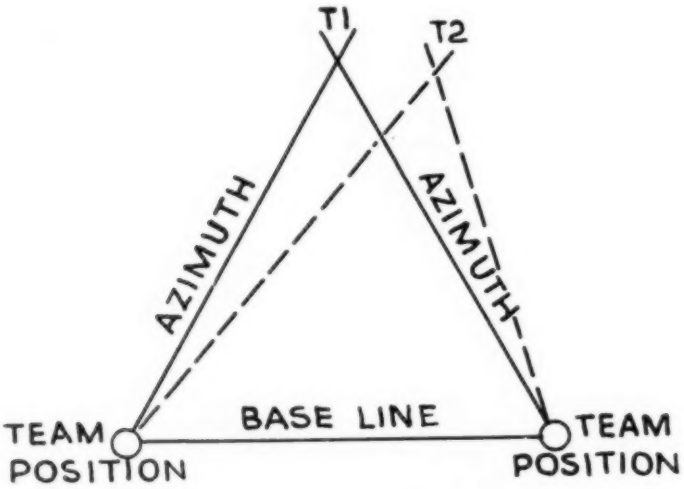


FIGURE 30.—Two teams at opposite ends of a BASE LINE of known length and azimuth convert data obtained from recorders to azimuth lines. Sound source is located at point of convergence of azimuth lines (T1). Subsequent targets (T2) are similarly located.

EQUIPMENT

A list of equipment essential for the operation of one team and a sketch showing this equipment set up for operation follows:

1—Microphone array consisting of three identical microphones connected by an electrical cord (CD-1238).
1—Microphone connecting cord, (CD-1239), which connects the three identical microphones to the recorder.
1—Recorder (BC-1323), basic component of the equipment.
1—Complete set of reel equipment (CE-11), consisting of a reel unit which holds approximately ½ mile of W-130 wire and a sound-powered telephone. (The two teams lay a wire line between their recorders.)
1—Handset (TS-10), which when connected to the recorder, provides basic communication between the two teams.
1—Battery (BB-54), consisting of three cell units connected in series to give a 6 volt battery. (4 issued per team.)
1—Power supply cord (CD-1241), used to connect recorder to battery, BB-54.
1—Headset (HS-35), worn by the operator.
1—Stop switch or control button which serves to stop both recorders simultaneously.
1—Computer, M414.
1—Aiming circle, M-1.

Associated equipment consists of:

1—Spare parts kit containing spare tubes, resistors, and capacitors.
1—Signal Corps Radio, SCR 300, which may be used as an auxiliary means of communication in the event wire lines go out. (3 - SCR 300's issued per squad.)
1—Power unit, PE-210, used as a battery charger and capable of charging twenty batteries at one time.

For transportation, the battalion counterfire squad is issued one ¼-ton truck with trailer. When it becomes impracticable to transport the equipment by vehicle to the

position of installation, the essential equipment may be transported on packboards.

Now, let us see how we obtain a range and an azimuth from the counterbattery position (CB) to the target (T).

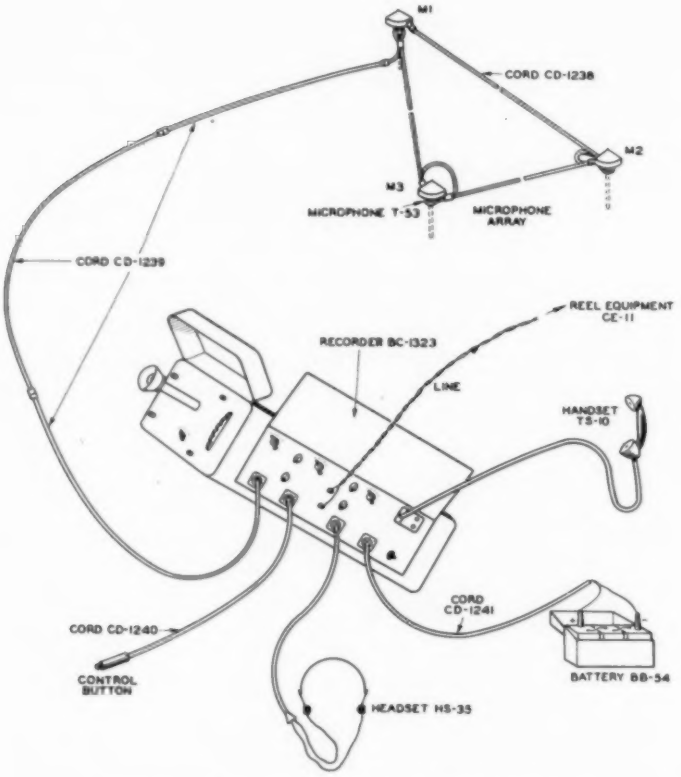


FIGURE 31.—Schematic diagram of GR-6 equipment.

Suppose that we have two team positions, right team, (RT), and left team, (LT), at the extremities of a base line of which we have predetermined the range and azimuth. Let us further assume that we have a target somewhere to our

front that is not visible from the two positions and which we wish to locate. This is possible through the use of GR-6 equipment providing the weapon at the target fires a shot thereby setting up sound waves which the equipment at each

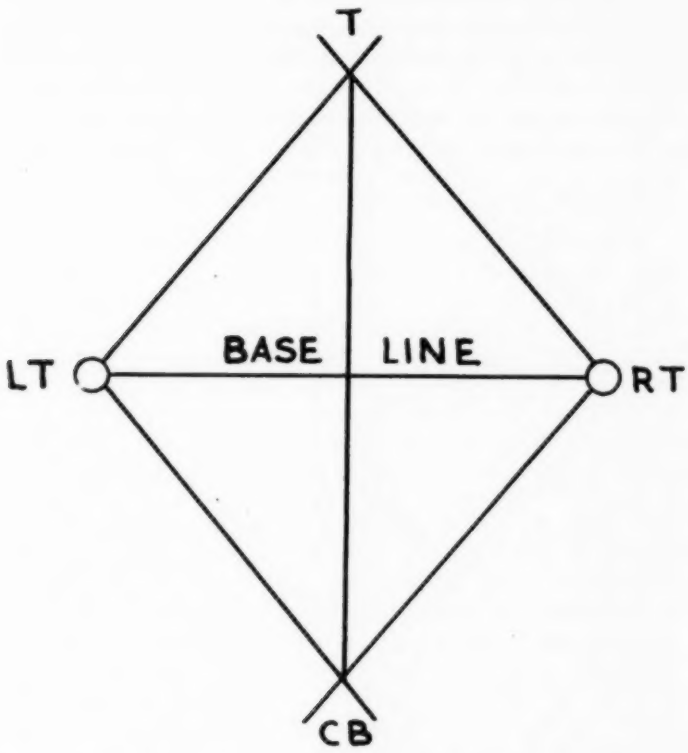


FIGURE 32.—Range and azimuth from counterbattery (CB) to target (T) is rapidly computed by geometric process utilizing two known angles and the included side.

team position may intercept. After interception of the sound waves it is possible for the operators to determine the numerical data previously mentioned, from the recorders. This data may be converted to magnetic azimuths

through the use of the computer, M414. When these azimuths are projected from each team position, an intersection results which is the location of the enemy weapon. In a like manner, the exact location of counterbattery, (CB), may be determined. If the base line and the azimuths which have been determined are placed on a map or a plot that has been drawn to scale, it is possible, by use of a protractor, to determine a range and an azimuth from counterbattery, (CB), to target, (T).

This information is sent to the counterbattery and fired or to a counterfire information center which directs the data to any or all supporting weapons that might be assisting that particular operation.

When selecting a site for operation, prime consideration must be given to the location chosen for the microphone array which consists of three identical microphones connected by a cable for installation as an isosceles right triangle. The triangle has two sides of 15 feet each and a hypotenuse of 21 feet 2½ inches. The hypotenuse should be placed in the general direction from which enemy gun sounds are expected to originate. For best results, an effort should be made to locate the microphone array on uniformly high, level ground in such a manner that there will be no more than six inches difference in elevation between microphones. It must not be inferred that the equipment will not operate if the microphones vary more than six inches in elevation, but rather that less accurate results will be obtained when they are. An attempt should also be made to locate the array in an area free from tall grass and undergrowth. If this is not possible, grass and undergrowth should be cleared or cut away before installing the array. Because of the characteristic of sound waves that causes them to rebound or bounce off obstructions, the array should not be placed near buildings or objects of any great size since the sound wave would pass over the array, strike and rebound, and pass over the array, once again. This causes what is termed as multiple arrivals which result in faulty data obtained from the recorder.

The microphone array is connected to the recorder by a connecting cable which has a separate circuit for each microphone. Each length of this cable is 50 feet and each team is issued three cables. This permits the operating personnel and the recorder to be placed 150 feet distant from the actual site of the microphone array. In field tests performed at Fort Benning, as many as twelve lengths of this cable have been used with no effect whatsoever on results obtained from the recorder.

As has been previously brought out, sound waves are propagated uniformly in all directions away from their source in the form of concentric circles. Theoretically, then, as the sound wave passes over the microphone array, it is in the form of an arc. However, we are interested only in that portion of the arc that passes over the array and this portion is so small that when it is several hundred yards distant from the source it becomes practically flat and for all practical purposes, may be considered a straight line. This portion of the sound wave is intercepted successively by the three microphones as it passes over the microphone array and causes the diaphragms of the microphones to begin vibrating. (See figure 33.) This vibration causes the microphones to set up slight electrical currents which pass through the separate circuits of the connecting cable into the recorder to recording heads. Each microphone is connected to a recording head; thus, we have three recording heads within the recorder numbered 1, 2, and 3 respectively and connected to the number 1, 2, and 3 microphones. Sounds are recorded separately by these heads, in the same time sequence as they strike the microphones of the array, on an endless, magnetic, steel tape. They are recorded in the form of a magnetic pattern. The steel tape is 48 inches long and rotates in a counterclockwise direction at a speed of 6-7 inches per second. When waiting to "trap" a signal, the recorder is in operation and the steel tape is rotating. When a signal is heard that the operator desires to "trap," the recorder must be stopped or the signal will be erased after a two second time interval by erasing heads. If the recorder is not stopped a continuous process of recording and erasing takes place.

Upon hearing a sound he desires to retain on the steel tape, the operator stops the recorder and turns the main control switch from the "RECORD" position to the "MONITOR" position. This action results in the recording and erasing heads being removed from action and three pick-up heads being placed into action. No more signals will be recorded and the signals that were recorded will not be

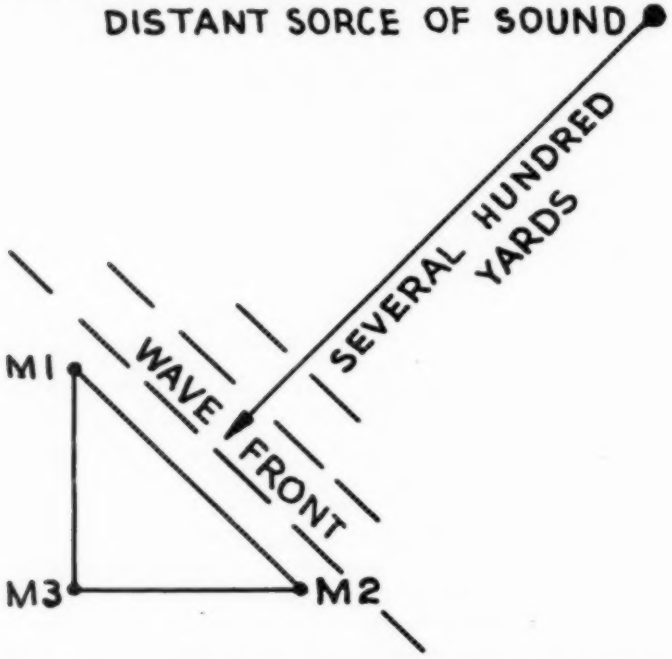


FIGURE 33.—Sound wave passing across microphone array M1, M2, M3 is picked up by the recorder. This data is converted into an azimuth by the computer.

erased from the steel tape. The recorder is now turned on again. Since the steel tape rotates when the recorder is operating, the signals that were recorded will be picked up by the pick-up heads each time they pass under one of these heads and passed into a headset worn by the operator. At the same time they are passed into the headset, the signals

are passed into an oscilloscope tube which is merely an electrical means of viewing the signal. In other words, the operator is able to both hear and see the signal.

The operator, through the use of the recorder, determines the linear separation between the signals recorded on the steel tape. These linear separations are actually the time differences of sound arrival at the three microphones and are read as such on counters mounted on the face of the recorder. This is the numerical data that is given to the computer who, in turn, converts it into a magnetic azimuth through the use of the computer M414.

Let us consider for the next few moments how we may determine the base line at the extremitics of which the two teams operate. There are three methods of doing this, each depending upon existing conditions. For sake of simplicity, let us consider them—beginning with the easiest and quickest method and progressing to the most difficult and slowest method.

Assume a situation in which the two teams are visible to one another. To obtain the azimuth of the base line, we could set up an aiming circle at the number three microphone of one team and "shoot" the azimuth to the number three microphone at the other team. Range of the base line could be obtained by pacing, estimating, measuring with a steel tape or by use of a range finder.

In the second instance, let us assume a situation in which the two teams are not visible to one another but a map of the terrain is available. We might locate the team positions in this case simply by inspection or by obtaining the azimuth to prominent terrain features and locating by intersection or resection. Range of the base line could be obtained by consulting the scale of the map.

In the third method we will assume that the teams are not visible to one another and that no map of the area is available. If these conditions exist, the base line is determined by use of the GR-6 equipment and a method called SELF-SURVEY. This method makes use of the wire line which the two teams lay between them from their number three microphones and through their recorders. Assume

that the right team is going to survey the base line. The computer calls the left team and tells them to prepare to self-survey. At this time, the plotter at the left team goes to their number three microphone. He takes with him a rifle, ammunition, and a sound-powered telephone which he connects to the wire line at the number three microphone. Upon command of the right team, he places the telephone in such a manner that it will catch the muzzle blast of the rifle and fires. The result is that two signals are transmitted to the recorder at the right team; one a telephone signal and the other an air signal. The signal transmitted over the wire line arrives at the right team's recorder much sooner than does the signal transmitted through the medium of air since signals that are transmitted by an electrical agency travel at the speed of light while sound waves travel at the rate of 1100 feet per second. The operator at the right team determines the time difference between these two signals. This time difference when multiplied by a speed number that may be obtained from the computer, M414, gives the range in yards of the base line. Azimuth of the line is obtained in the same manner as the azimuth to an enemy weapon is obtained.

For practical purposes, the base line is usually limited to approximately 700 yards, and should equal at least ⅓ of the range to the enemy weapons. As has been stated earlier, a two second time interval exists between the recording heads and erasing heads within the recorder. Sound travels at the rate of 1100 feet per second or 2200 feet (733 yards) in two seconds. From this it would seem that the absolute range of the base line could never exceed 733 yards, but such is not the case. In the event a longer base line is desired, a man may be sent out to a mid-point between both teams and each team may survey on a shot fired by this man. Since each team can survey 700 yards, this would enable them to survey a base line of 1400 yards.

A base line of 700 yards will enable accurate locating of enemy weapons up to approximately 2,000 yards. Locating weapons beyond this range is usually impracticable with any degree of accuracy. However, this range usually in-

cludes most of the enemy's heavy machine guns and mortars. Smaller weapons, of course, may be located with the equipment but it is usually not considered profitable because of their mobility and probable movement before effective counterfire could be brought to bear.

In conclusion, let us consider how the sound locating set may be integrated into the regimental fire plan and its tactical association with counterfire weapons. The GR-6 squad usually will be assigned to a front-line battalion and placed under battalion or regimental control.

There are, in general, three approved methods of GR-6 employment with counterfire weapons. The method, or combination of methods, to be used will be determined largely by the terrain and the type of operation. The names of these three methods suggest terrain distances and communication facilities involved and are known respectively as the immediate, close, and remote methods.

In the immediate method the counterfire weapons are employed immediately in rear of the GR-6 installation 5-15 yards. The weapons most likely to be employed in this method are the 60 and 81-mm mortars. Several advantages are offered when using this method. Range and azimuth may be applied directly to the weapons and the mortar personnel do not have to obtain a base azimuth since they may use a line which is the prolongation of the 1-3 side of the microphone array. Surprise fire can be delivered more quickly through use of this method than either of the other methods.

Disadvantages, however, are that good array positions seldom make good gun positions. The presence of additional personnel near the microphone array is not desirable since it adds to the general confusion and hinders efficiency of the GR-6 in addition to the fact that the additional personnel are likely to draw enemy fire. The mortars cannot be used to their greatest advantage as they cannot fire on targets other than those located by the GR-6 because interference and confusion with GR-6 operation would result.

In the close method the counterfire weapons are usually located some distance to the rear of the base line and some-

where near the approximate center of the line. In this method, as in the immediate method, the GR-6 works directly with the counterfire weapons. The counterfire weapons, however, have a greater latitude in the selection of positions and they can fire on targets other than those located by the GR-6. Disadvantages are that it requires time for the survey of the counterfire position and any errors made in the surveys are introduced into the firing. The method necessitates additional communication facilities.

In the remote method the three battalion counterfire squads work directly under the control of the counterfire officer. This method necessitates the use of a fairly large scale map. The counterfire officer must plot the control team locations and the location of all available counterfire agencies on the map. As the control teams radio or telephone target locations to the counterfire officer he must plot them on his map and request fire from the counterfire agencies. The method makes GR-6 data available to command echelons for information purposes and for placing of counterfire by any supporting weapons. However, it requires accurate maps of fairly large scale and a close tie-in of communication between GR-6 personnel and command echelons.

The GR-6 set is potentially a very valuable piece of organic infantry equipment but its actual combat value is dependent on two prime factors; adequately trained operating personnel and mutual cooperation and understanding between tactical commanders and counterfire agencies. Training of specialized personnel to operate the sets does not offer too great an obstacle and can be accomplished on the regimental level. However, inculcation of a new idea such as accurately locating enemy weapons by sound, requires dissemination of accurate factual information down to the platoon level. Only when the noncommissioned personnel of the mortar platoons as well as the officers understand the GR-6 and have faith in the data obtained from it will the maximum value be realized from this equipment.

CHAPTER 4

Terrain Model DeLuxe

The purpose of presenting this article is to explain how to make an efficient and flexible terrain model using ordinary fly screen and various accessories.

The use of fly screen for a terrain model is not in itself a novel idea. However, heretofore, the use of screen has been restricted to instruction in fire adjustment and sensing for mortars and artillery. As we all know, the ordinary sand table is quite suitable for teaching a great variety of subjects but there are certain limitations to its use. The sand is heavy; instruction of groups larger than a squad, unless seated on stands, is most difficult; and military movements or actions are difficult to represent with the desired realism. These limitations do not exist to as great an extent in a fly screen model.

By way of amplification, the terrain model described in this article is 10'x14'x1'. Four men can carry it with comparative ease while a sand table of the same size would be much heavier and more difficult to move. In addition, it is difficult to place a large group around a sand table unless bleachers or stands are available. —tilt the sand table?— surely, but how much can you tilt the sand table without losing the terrain you sweated to make just so? —pour plaster of Paris over the sand to make it hold its shape? —that is good but the sand has lost its flexibility. Therefore, it would be more advantageous under certain conditions to make the model of fly screen and tilt it as high as as desired, enabling any size group of students (depending on the size and scale of the model) to receive instruction.

Portrayal of action on a fly screen model, whether it be the maneuver of model tanks or infantry units, is greatly

facilitated because the screen, although it can be easily painted and the holes of the screens filled, is porous. Operators can BLOW through it, POKE things through it, SEE through it, or PULL things through it. Making full use of this characteristic of a fly screen model enables an instructor to give a problem with an atmosphere of realism which is difficult to obtain from a sand table and in many cases, from a tactical walk.

FIGURE 34 (1).—Terrain Model showing outpost line, main line of resistance, and position of reserves.

FIGURE 34 (2).—Terrain Model showing outpost line withdrawn, one B Co platoon position overrun, smoke screen, and reserves moving forward.

The sand table is comparatively simple to construct. A fly screen model such as is considered here is not difficult to build if the necessary steps in construction are studied and solved one by one. It should be understood before beginning the construction of a screen terrain model that it isn't something to be built this week and torn up next week.

Because of the nature of its construction, it is a permanent type of training aid. At the same time, by use of the various accessories, many types of problems can be portrayed on the model.

Listed below are some of the points which must be considered before starting to construct a terrain model:

1. Location of the model.
2. Size of the class.
3. Size of the terrain model (governed by the size of the class).
4. Type of terrain desired and whether photomaps and contour maps of the terrain desired are available.
5. Requirements of the problem (machine guns firing with sound effects, maneuvering of tanks, representation of artillery fire, etc.).
6. Materials and tools available for the actual construction of the model.
7. Personnel available to construct the terrain model and present the problem.

In constructing the model described in this article, all of the above things were kept in mind. Their importance might best be brought out by explaining how they affected the construction of this particular model. It is understood that it is more difficult to obtain various things at some army posts and in some units than it is in others, but most of the materials used can be easily obtained at any army post or similar installation.

To the officer in charge of constructing this model, the process seemed to be a series of requirements large and small, which called for solutions. The part of this article which deals with the actual construction of the model will be presented in this manner, each requirement followed by a solution complete with explanation, diagrams, and helpful hints.

REQUIREMENT I:

What is the best location for the presentation of the problem?

SOLUTION:

Due to demobilization there any many empty buildings on most army posts. The best type of building is an unused War Department Theater building. There you have a stage, light can be controlled, and the weather need not interfere during the construction of the terrain model or the conduct of the problem. However, a building need not be a prime requisite for the conduct of the problem.

REQUIREMENT II:

How is the size of the terrain model determined?

SOLUTION:

Following are the factors considered in determining the size of the terrain model:

1. Size of the class to receive the instruction (average 150 students).
2. Maximum distance members of the class are to be from the model.
3. Size of installations to be represented by the model (platoon areas, tanks, etc.).

After considering the above factors the size decided upon for the model was 10′ x 14′ x 1′.

REQUIREMENT III:

The nature of the terrain is known to the students very well, therefore, the model must be accurate in its representation of the terrain. What is a good method of making a fly screen terrain model to scale?

SOLUTION:

Once having determined the size of the model, one should obtain the following materials in order to make an accurate terrain model to scale (See figures 35, 36, 37 and 38.):

1. Contour map and photomap of the area to be modeled.
2. Enough ¼-inch wall board or ¼-inch plywood to make a panel 10′ x 14′.
3. An opaque projector (Bell-optican).
4. Black and red china-marking pencils.
5. Approximately 24′ (linear) of 2″ x 4″ lumber.

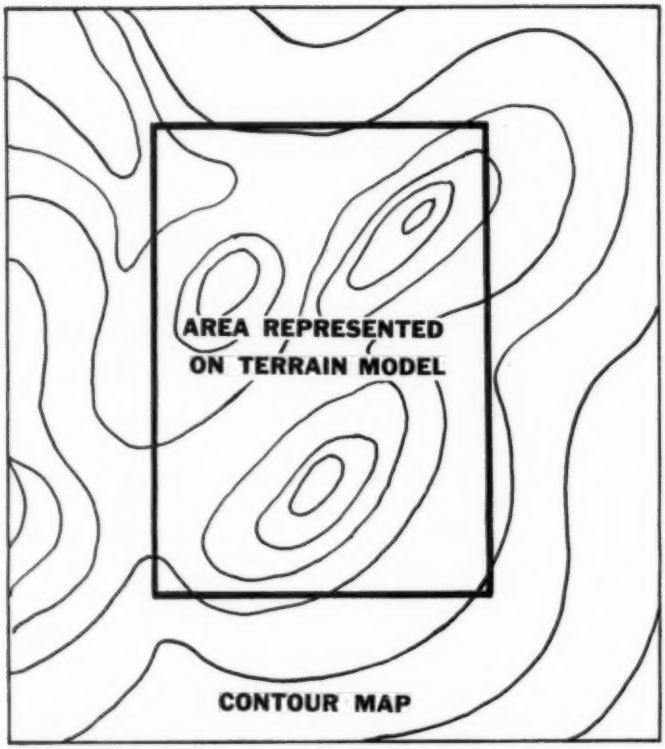


FIGURE 35.—On the contour map mark off the area that the terrain model is to represent. Be sure that the area marked off is in proportion to size of the finished terrain model which in this case is 10′ x 14′.

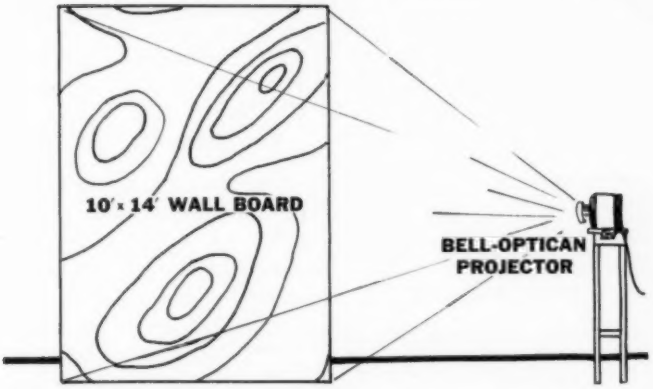


FIGURE 36.—Use the opaque projector to project the desired portion of the contour map onto the 10' x 14' panel and trace the contour lines with the red china-marking pencil. (If the difference in elevation between the highest and lowest points to be represented on the terrain model is less than 100' on a 10' contour interval map, it is believed that the tracing of only 3 contour lines will be necessary.)

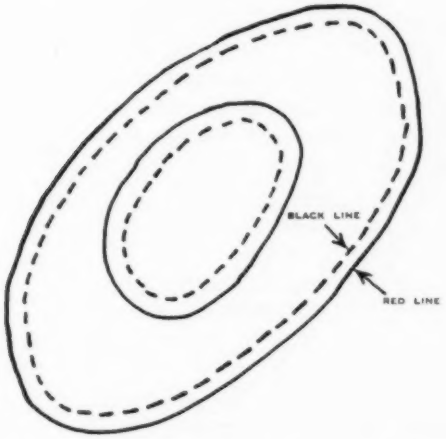


FIGURE 37.—After tracing all of the desired contour lines with the red china-marking pencil, use the black china-marking pencil to make another line approximately 1½" inside of each red contour line. After this has been accomplished, use a jig-saw to saw out each contour, following the red line first and then the black line. This will produce a contour 1½" wide.

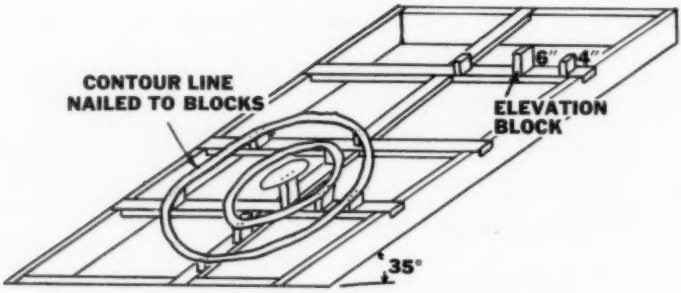


FIGURE 38.—Once the contour lines have been sawed-out, the next job is to raise them to their proportional elevations. First a frame for the entire model must be made with the outside dimensions of 10′ x 14′. The bottom board of the frame must be flat on the floor whenever the problem is presented, so the angle at which the model is to set must be decided upon at this time and the frame so constructed. An angle of from 35° to 45° is considered satisfactory. The frame must have some cross pieces that will serve as bases for the small blocks that hold up the contour lines at various elevations. Once the frame has been made, lay the contour lines on the frame in order to find out how many elevation blocks will be needed for each. Assuming that only 3 different contour lines were cut out; namely, the 100′, 150′ and 200′ lines, and that 2″ are going to represent 50′ in elevation then saw out of the 2″ x 4″ all of the 4″, 6″ and 8″ elevation blocks needed.

REQUIREMENT IV:

How is the fly screen molded to make different terrain features?

SOLUTION: (See figure 39.)

Once the contour lines have been set at their proper elevations, the terrain features can be seen readily and generally it is just a job of laying the fly screen over the contour lines and shaping it with the hands in order to obtain the desired features. The greatest difficulty encountered is that due to hill masses which have to be represented, the screen has to be trimmed, sewed, and nailed on to various parts of the framework. It might be mentioned at this time that soldering two pieces of fly screen does not work very satisfactorily if one expects to slide accessories over the finished model. If during the modeling process, a hump or unwanted ruffle appears on the fly screen, it can be taken out by making a small slit in the screen near a contour line where it will hardly be noticeable.

REQUIREMENT V:

What is the best method of painting the fly screen?

SOLUTION:

The screen should be given 2 coats of enamel paint. To avoid a great deal of difficulty and to economize on paint it is best to stand the model almost perpendicular so that paint which runs down the screen serves to cover the holes. The first coat of paint will not cover all of the holes, but the second coat will leave a fairly smooth surface. If the terrain represented by the model is predominantly green because of grass, etc., it is well to use green for the second coat. To emphasize hills or valleys a darker shade of green is used on the side that will be shaded from the light. A third coat of non-glossy paint may be given the finished model. Camouflage paint is ideal for this purpose; flat house paint is next in preference. All installations (platoon areas, boundaries, etc.) should be painted a light blue or white.

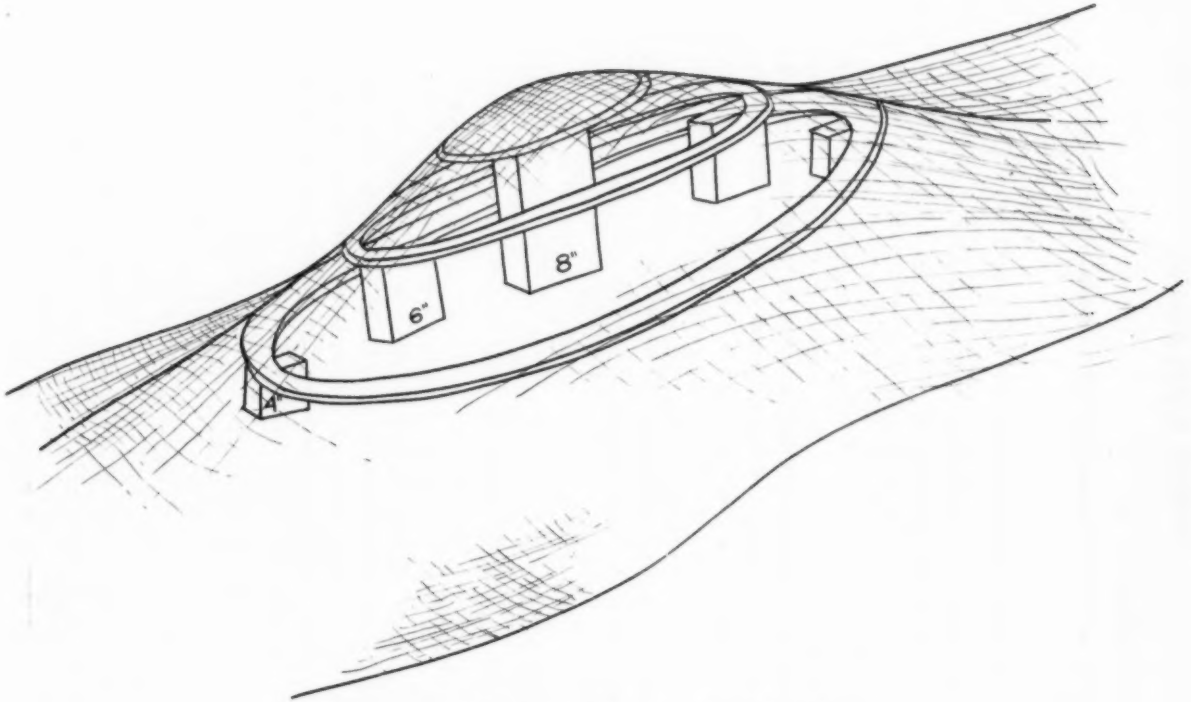


FIGURE 39.—Fly Screen molded over elevated contours.

REQUIREMENT VI:

How are trees represented and attached to the model?

SOLUTION:

Trim branches from pine trees until they are 1½" to 2" in length and dip in green enamel. Punch small holes in the fly screen and, while the trees are still wet with the enamel paint, push them into the holes. When the enamel dries it holds the trees in place so well that only abnormally rough treatment will shake them loose.

REQUIREMENT VII:

Briefly review the type of problem to be presented with the aid of the terrain model and the requirements the terrain model is expected to fulfill.

SOLUTION:

The name of the problem to be presented is "The Conduct of Defense." During this problem a complete battalion defense will be shown in position to include units on the combat outpost, units on the main line of resistance and units in the battalion reserve area (see figure 34). Machine guns will be portrayed firing their sectors of fire and firing their final protective lines. The mortars need not be shown firing their sectors of fire, but their primary target areas will be shown. Firing of recoilless weapons will be represented. The normal barrage of the artillery will be shown being fired. The combat outpost will be in position initially but to avoid becoming engaged in close combat with the enemy will withdraw. Therefore, the units on the combat outpost must be shown withdrawing.

During the presentation of the problem the enemy is going to make a penetration into our main line of resistance, completely annihilating one of the front-line platoon defense areas. This platoon area must be made to disappear. At approximately this same time the support platoon of one of the front-line companies will move from its assembly area to a previously prepared position. The assembly area must disappear and the prepared position, which is shown by a dotted symbol, must be shown as becoming occupied.

After the penetration has occurred, a counterattack by the reserve company preceded by tanks will be portrayed. The counterattack will move so as to hit the penetration on the flank. The reserve company must be shown splitting up into its platoons as each platoon goes on to accomplish its mission. The penetration must be shown as being covered by artillery, mortar and small arms fire. As the rifle platoons of the reserve company move in to accomplish their missions, the platoon defense position that had been taken by the enemy must be shown as being gradually restored.

Throughout the whole problem it will be necessary to point out various installations and places and to show the passage of time. Since a pointer for the instructor will be awkward to use, devise a pin-point light that will illuminate the location being discussed.

REQUIREMENT VIII:

How is the combat outpost made in order to show its withdrawal at the proper time?

SOLUTION: (See figure 40.)

The outguards may be cut out of cloth. A word of caution must be given at this time as each outguard must be cut out of one piece of material. If this is not done great difficulty will be encountered in trying to make the cloth cut-out lie smoothly on the model. In order to make the cloth cut-out disappear, a slit in the screen is made through which the cut-out is pulled. The slit made in the screen should have a tin lining to facilitate the sliding of the cloth through the slit. If the terrain feature on which the cloth outguard cut-out is to be placed is steep and the cloth has the tendency to slip, small ½-inch pieces of transparent tape may be used to hold the cloth in place.

During the conduct of the problem when the proper cue is given, the tab attached to the material hanging underneath the model is pulled, making the combat outpost disappear.

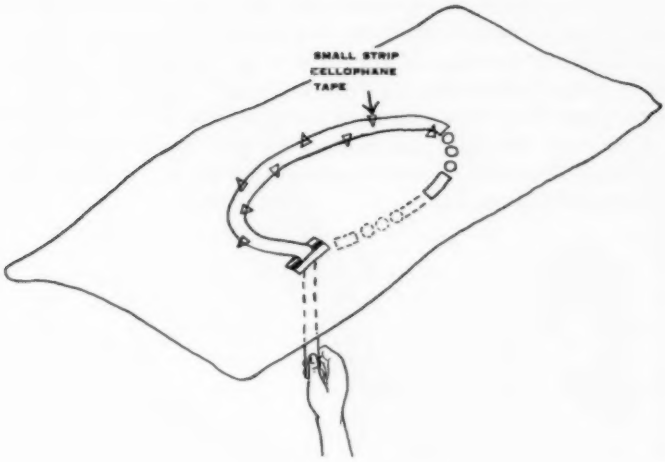


FIGURE 40.—Method of withdrawing platoon symbols.

REQUIREMENT IX:

How are machine guns represented firing their sectors of fire and final protective lines?

SOLUTION: (See figure 41.)

Machine guns are represented by a small flashlight bulb protruding half way through the screen and located so that it is in the center of the dot in the military symbol for a machine gun. For detail as to how to fasten the light bulb to the screen, see figure 42. Whenever the machine gun is firing its sector of fire, the light bulb is turned on at the switchboard so that it will flicker. For detailed construction of the switchboard, see figure 43. It might be mentioned at this time that using the fly screen for the model eliminates one of the two wires which would ordinarily be needed to light the flashlight bulb because the fly screen is a good conductor of electricity and it can be used as the common conductor for all of the light bulbs that might be needed for the presentation of the problem.

To represent the machine guns firing their final protective lines a piece of red-dyed engineer tape is used. (Engineer tape is mentioned here but any cloth material that is fairly heavy and closely woven will be suitable.) Whenever it is desired that the machine guns fire their final protective lines the desired piece of tape is pulled underneath the model and the light bulbs are flickered at the same time. For a simple way of constructing and installing these FPL tapes, see figure 41.

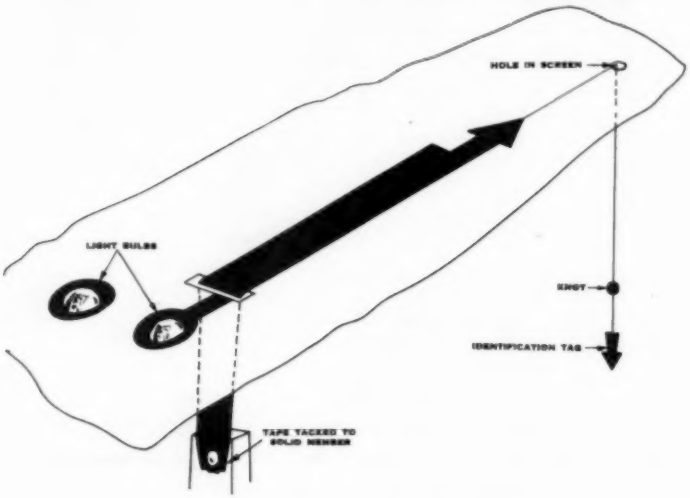


FIGURE 41.—Method of pulling (firing) symbol to its full length to depict firing of final protective lines.

REQUIREMENT X:

How is the firing of recoilless weapons represented?

SOLUTION: (See figure 44.)

The conventional symbol for the recoilless weapons is painted on the surface of the model. The screen is then perforated in such a manner that the perforation is in the shape

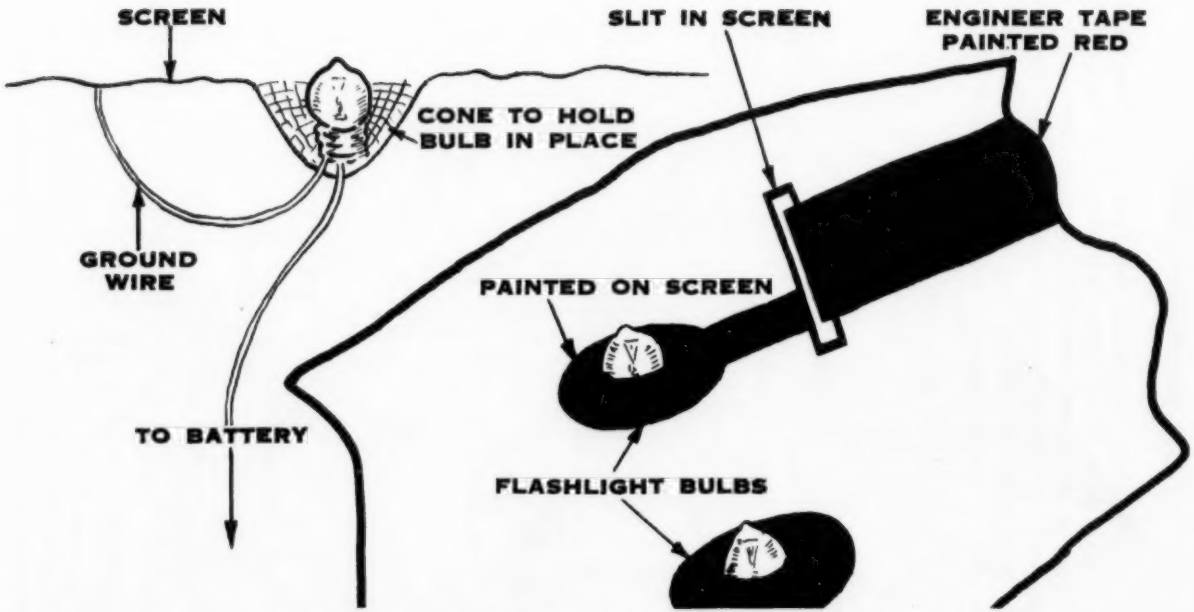


FIGURE 42.—Method of emplacing light bulbs to indicate firing.

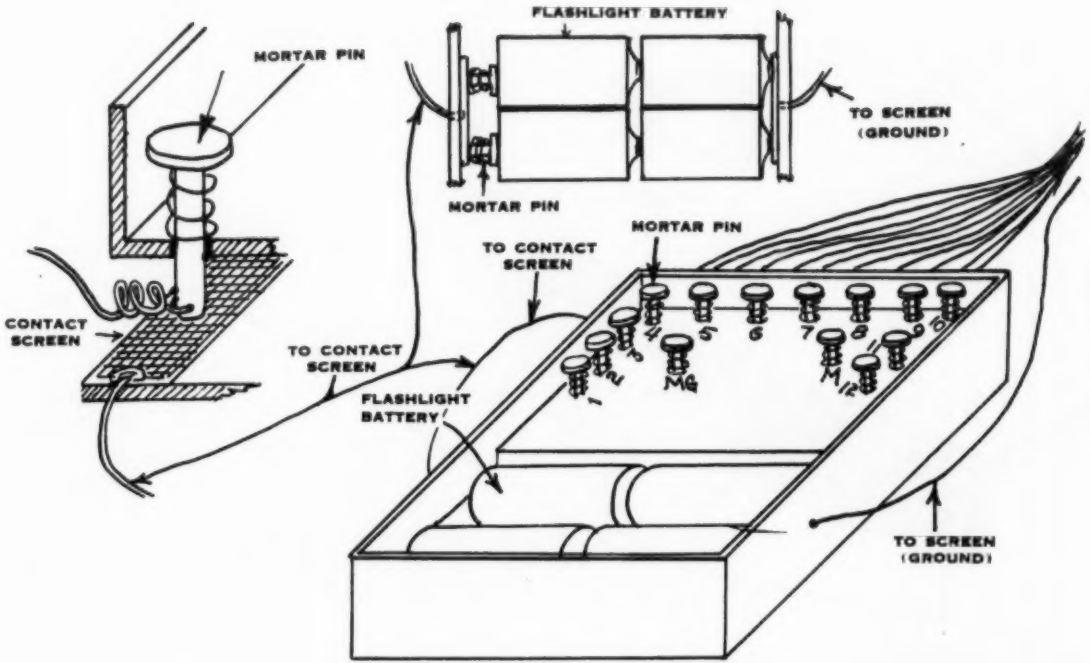


FIGURE 43.—Operation switchboard which controls flashing of light bulbs.

of the breech blast and muzzle blast of the recoilless weapon. A flashlight bulb is then fastened to the undersurface of the fly screen and whenever the bulb is lighted, the light on the upper surface of the terrain model appears in the shape of the breech and muzzle blast of a recoilless weapon. For detail of construction see figure 44.

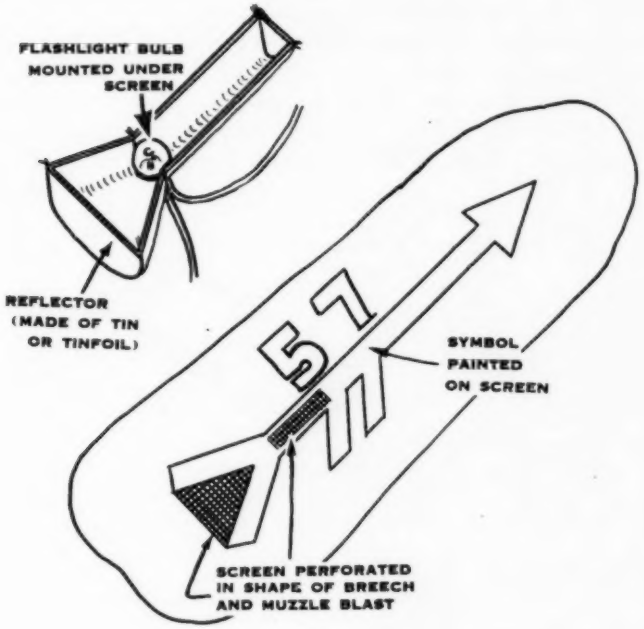

FLASHLIGHT BULB MOUNTED UNDER SCREEN
REFLECTOR (MADE OF TIN OR TINFOIL)
57
SYMBOL PAINTED ON SCREEN
SCREEN PERFORATED IN SHAPE OF BREECH AND MUZZLE BLAST

FIGURE 44.—57-mm recoilless symbol.

REQUIREMENT XI: (See figure 45.)

What is the smoke agent used to represent mortar and artillery fire and what devices are used to release it at the desired locations.

SOLUTION:

The smoke agent used throughout the entire problem is sulfurtrioxide (FS). As it is commonly used by the Air Corps, this gas may be obtained with little difficulty at any air field or from the Chemical Warfare Service. A pint of the liquid will last for months. For details of the devices used, see figure 45.

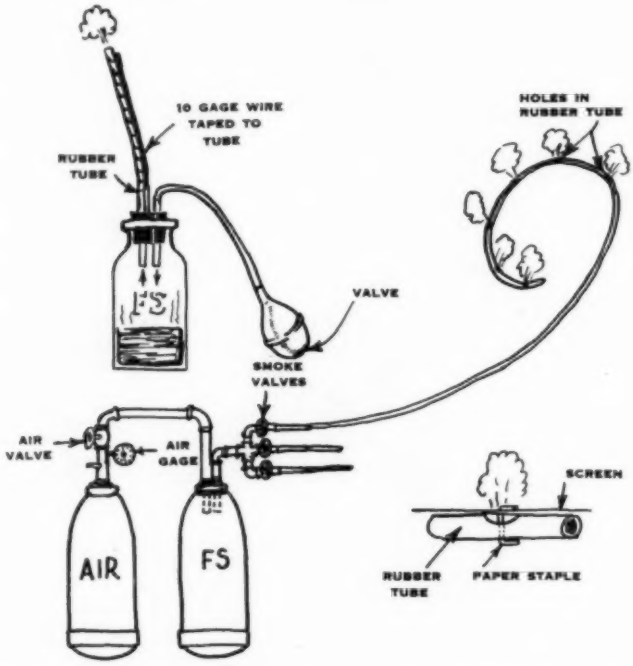


FIGURE 45.—Small smoke generator to portray individual rounds of mortar and artillery and generator with large capacity output to portray heavy concentrations of fire or barrages.

The small device shown in figure 45 should be used to portray individual rounds of mortar and artillery and the high capacity device shown should be used to represent very heavy concentrations of fire or barrages.

REQUIREMENT XII:

How are the conventional symbols for the 81 or 60-mm mortar primary target areas and for the artillery normal barrage made to appear whenever they are being fired and disappear when the fire has been lifted?

SOLUTION: (See figure 46.)

The exact locations where the primary target areas of the mortars and the normal barrage of the artillery are going to appear are drawn with chalk. The upper surface is then perforated, care being exercised to perforate the screen exactly to the width of the lines of the symobls. The shapes of the primary target areas must be to scale. Since these

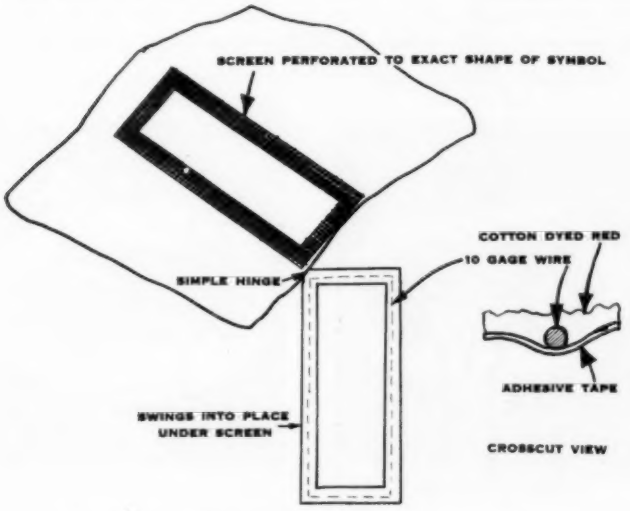


FIGURE 46.—Method of showing primary target areas.

symbols are going to be placed on the undersurface of the screen so that they can be seen through the perforation it is best to make first a frame of wire (10 gauge) that will be the exact size and shape of the perforated symbols. The wire must be shaped to fit the shape of the terrain in order

that the finished symbol will fit smoothly against the screen. Once the wire frame has been constructed, use ordinary white adhesive tape, as shown in figure 46, to adhere brilliantly red-dyed absorbent cotton to the wire frame. Whenever these symbols are to be shown they are merely swung into place and they will show through the perforated screen.

REQUIREMENT XIII:

How is the penetration of one of the front-line platoon defense areas by the enemy shown and how is the restoration of the same position by friendly troops portrayed?

SOLUTION: (See figure 47.)

The location of the enemy is indicated by the instructor. The penetration effected by the enemy may be shown by having a platoon area gradually disappear. This can be

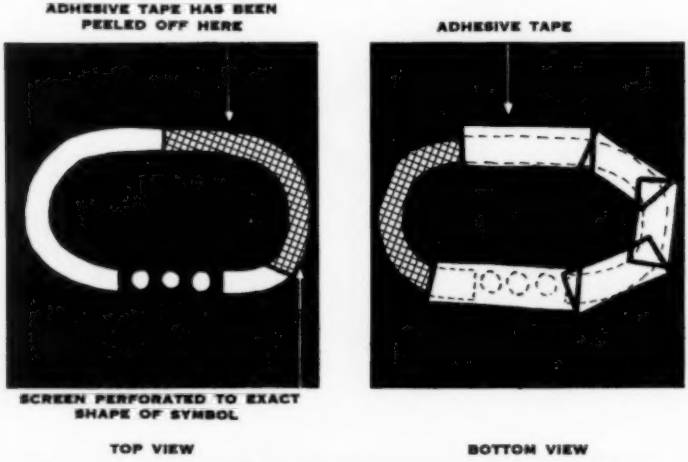


FIGURE 47.—Method of showing penetration, overrunning and restoration of platoon positions.

effected by taking advantage of the characteristics of the fly screen. The area that is going to be penetrated is first drawn with chalk on the upper surface of the terrain model. This area is then carefully perforated making sure that the

perforation is clean and neat. Once this has been done take ordinary adhesive tape (obtainable from the infirmary) and stick it to the *under* side of the screen. The perforation of the screen will allow the adhesive tape to show through very clearly. Whenever it is desired to show the penetration being made by the enemy, the strips of adhesive tape are merely pulled off the under side of the screen. Upon restoration of the penetrated position by friendly troops, replace the tape on the under side of the screen.

Great realism can be obtained in the presentation of these situations by proper timing and logical removal of the adhesive tape in accordance with the situation. If the enemy is described as effecting a penetration along the front of the platoon area the tape should be pulled from that particular area first.

REQUIREMENT XIV:

How are the model tanks constructed and operated?

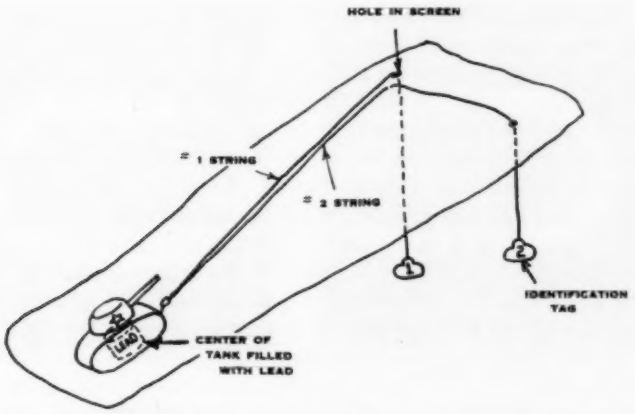


FIGURE 48.—Method of mainpulation of strings attached to tanks permitting them to maneuver and change direction.

SOLUTION: (See figure 48.)

The tanks are hand made wooden models—the simpler the better. The tanks are going to have to maneuver on the surface of the terrain model, the model is going to be set up at

an angle, and there will be a tendency for the tanks to slide around and tip over unless a hole is drilled in the body of the model and filled with lead or any other suitable metal to provide extra weight. The tanks may be pulled from one location to another by strings. The number of strings used on each tank will determine the different directions that the tank may be maneuvered.

Five tanks are to be used in this problem and all five may be moved simultaneously by tying the strings to a windlass made from a shell container.

REQUIREMENT XV:

How is the infantry company following the tanks during the counterattack portrayed and how is it shown splitting into platoons.

SOLUTION: (See figure 49.)

Individual riflemen could not be portrayed on a model of this size to any advantage. The rifle company following the tanks is represented by a cloth arrow approximately three times the size of a tank. This arrow is towed by one of the tanks by means of a string approximately 12-inches in length. The tank that is to tow the arrow has a definite path to follow. On this path and at the location which is picked out for the splitting of the company into platoons, a slit is cut in the screen exactly like the one used for pulling the final protective lines. When the towing tank passes over the slit a small wire hook is pushed through the slit, engaging the string and pulling the company arrow through the slit. To show the company splitting into platoons, cut out three small cloth arrows. To these arrows tie strings which will be used to pull them to their desired locations. Next, cut another slit in the screen in such a manner that it will form a "T" with the slit through which the large (company) arrow is pulled. The actual splitting of the company into platoons is done by simultaneously pulling the large arrow down through the slit over which the towing tank passes and pulling up through the screen by prearranged

strings the three small arrows which represent the platoons. As the three arrows are pulled to their designated locations in the penetrated area, the adhesive tape mentioned in the solution to requirement XIII is replaced gradually.

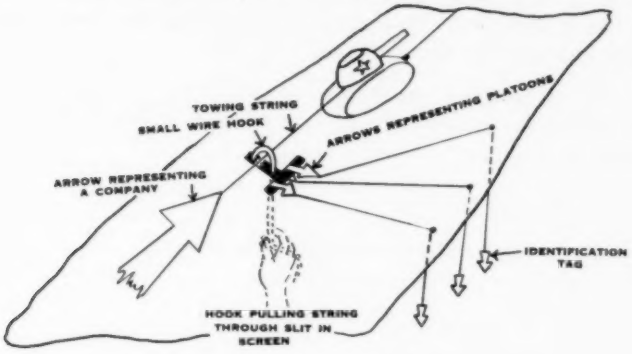


FIGURE 49.—Method of withdrawing arrow representing company and substituting arrows representing platoons which can be made to maneuver on the model.

REQUIREMENT XVI:

What type of clock should be used to portray problem time?

SOLUTION: (See figure 50.)

The clock portraying problem time should be constructed so that its operation is not distracting to the class. Therefore, the operator will have to move the hands from behind the clock. The clock should have two faces—one on the front and one on the back with the numbers on the back of the clock painted on counterclockwise. The hands on the front of the clock should be co-axially mounted with the hands on the back of the clock. In this way, whenever the operator moves the hands in back of the clock a corresponding movement will be made by the hands in front of the clock.

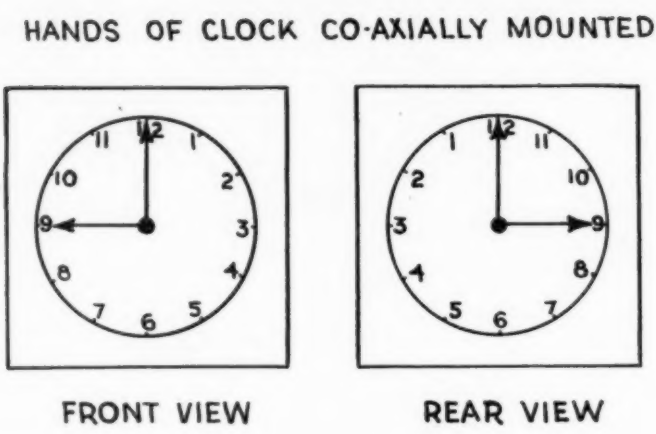


FIGURE 50.—Double-faced clock for depicting problem time.

REQUIREMENT XVII:

What is the general set-up required to operate the terrain model in regard to personnel, stage properties, etc.?

SOLUTION: (See figure 51.)

Six persons, including the instructor conducting the problem, are used to operate this model. Their locations and duties are best illustrated by the diagram below. The equipment for the operation of the model has been described with the exception of the following which need little explanation: the spotlight, the phonograph, amplifiers, and fans.

The lighting of the terrain model should be such that all glare is eliminated. Therefore, the one spotlight should be located in such a manner that the light will not reflect into the eyes of the class. The angle of the terrain model must be considered and in this case the light was placed approximately 15′ in front of the model and at a height even with the top of the model. To simulate daylight conditions, an ordinary 500-watt bulb will suffice, and to simulate night conditions a green or blue cellophane filter may be placed over the lens.

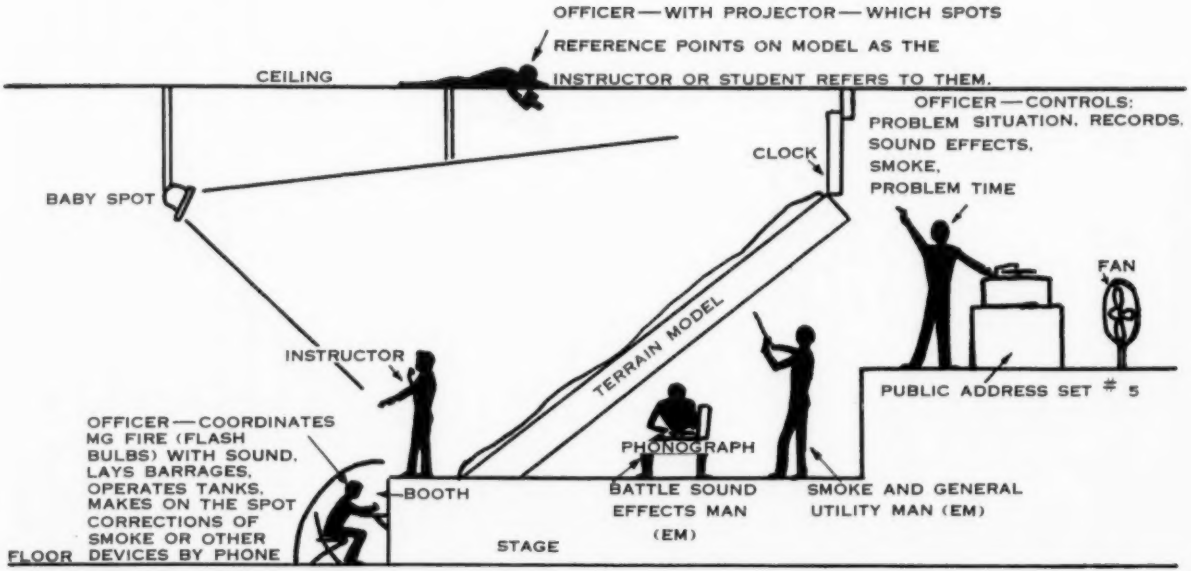


FIGURE 51.—Operation of terrain model.

A 35-mm film strip projector is used to project a small spot about 1½" in diameter which is used instead of the conventional instructor's pointer. This spot focuses the attention of the students on a particular location being discussed either by the instructor or by the students themselves. The person operating this projector must be so located that he can hear all discussion and spot the location being discussed.

The phonograph used for sound effects (machine-gun, artillery, etc.) is a regular issue phonograph borrowed from the I & E office. It is important that the phonograph used have a volume control for the purpose of simulating incoming, outgoing, or overhead artillery shells. For an incoming round, catch the whine of the shell with low volume and increase the volume until the explosion occurs. For an outgoing round, catch the whine of the shell with low volume, increase the volume, and then decrease the volume again prior to the explosion of the shell. The person who operates the smoke which visibly represents the artillery or mortar fire should coordinate his puff, which will appear on the upper surface of the model, with the explosion of the shell heard from the phonograph.

The sound records for machine-gun fire may be handled in much the same way as the sound for the artillery and mortar fire. The volume control in the firing of machine guns serves only to give relative distances of machine guns from the location in which a particular situation is taking place. The person operating the machine guns—that is the flickering of the flashlight bulbs—coordinates this action with the sound of the machine-gun record.

The sound of machine-gun, rifle, mortar and artillery fire can all be recorded on one disc in the proper sequence, simplifying the work of the person operating the phonograph and assuring smoother functioning of all sound effects.

The fan shown in figure 51 is used to blow excess smoke from behind the model. This adds greatly to the comfort of the operators behind the model because the fumes from sulfurtrioxide are not conducive to easy breathing. Care

should be taken not to fill any of the containers more than half full. If the bottle containing the FS is filled more than half way, emission from the rubber tube will be a liquid instead of smoke. (The liquid will eat holes in clothing, irritate the skin and may damage strings which operate some of the accessories used with the model.)

Cue sheets should be prepared for all persons concerned with the operation of the model. This is necessary to assure smooth functioning during the presentation of the problem. Almost all of the accessories for the fly screen model are manually operated and designed to be operated simply thus eliminating as many fancy gadgets as possible. In this way the chances are diminished that something which cannot be readily fixed may go wrong.

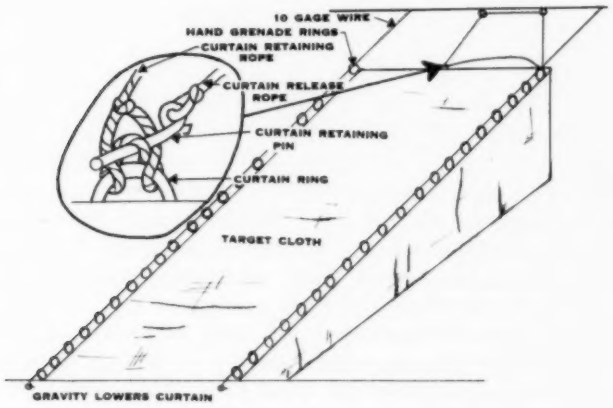


FIGURE 52.—Method of mounting and release of target cloth covering, making possible a surprise unveiling of terrain model.

A signal corps amplifier is used to integrate the microphones and the record player so that the transmissions will conform to the problem situations. The situations that may be presented by means of a record or by means of a backstage skit will vary greatly. Following is an example of a typical situation in the problem, "Conduct of the Defense,"

which might be presented with the aid of the model and some accessories. (Included are the various actions of the personnel required to operate the model.)

In order to bring the reader up to date, situations have been presented which required the students to give solutions and in which the combat outpost has been driven in, the units on the main line of resistance have been probed by the enemy, the enemy has delivered a heavy barrage on the right platoon of Company "B" on the main line of resistance, and penetration of the position by the enemy is imminent. This corresponds to situation #12. Whenever the instructor hits the cue words of "The action continues hot and furious in Baker Company's sector."—*the record man sets the clock at 0630, the sound effects man starts his record on heavy machine-gun and artillery fire, the smoke man smokes the platoon area, and the machine-gun man flickers the light bulbs firing the machine guns.* The instructor continues with, "Perhaps we should go back there and see if we can help. There is a messenger headed for the company command post in a big hurry."—*The record man starts his situation record #12.* —"Let's follow him." Messenger: (Recording via offstage microphone) (Excitedly) —"Where's the executive officer? I have a message for him!" Executive O. Co. B: "Over here." Messenger: "Sir! The captain and the artillery observer got killed just as they got down to our platoon. Lt Rightplat sent me back to tell you he's firing his final protective lines—" *sound effects man pulls final protective lines of machine guns so that they will show on upper surface of terrain model"*— he wants more artillery and some help. We've lost a lot of men, sir. The enemy are right on top of us; they keep on coming—lots of 'em!"

Sound effects, smoke, and flickering of flashlight bulbs continues.

1st Sergeant: "Excuse me, lieutenant, the left platoon just called on the 536. They are being shelled heavily; but not many casualties. They got hit from the front, but broke it up with small arms fire. They want to know what's going on."

(End of record.)

Sound effects, smoke and flickering of flashlight bulbs continue until the instructor conducting the problem begins to talk.

He says, "You are the Executive Officer of Co. B, what are your actions and orders?" He calls on various students for solutions and after a suitable discussion has taken place he announces a solution to include:

1. Informing support platoon leader of situation. Telling him to move to and occupy his previously prepared position.

2. Calling for final protective fires of all weapons.

3. Notifying battalion of the situation and actions he has taken and requesting another artillery observer.

4. Going forward to the company observation post.

5. Sending a messenger back to the right platoon with information as to what he has done and orders that the position be held.

The above is a typical situation which can be very realistically presented because the students can hear what is going on via the recording of conversation and sound effects and can see on the terrain model what is going on and where it is taking place. This creates a great deal of enthusiasm on the part of the students and thus facilitates learning.

CHAPTER 5

Engineer Combat Battalion (Infantry Division)

1. INTRODUCTION.—This is a brief orientation for infantry officers on the engineer combat battalion organically assigned to the infantry division. It describes the organization of the combat battalion, its supply functions, and its support operations including its use in the defense, in attack and pursuit, in retrograde movements, and in river crossings. Military experience has proved that component arms and services of the division must be an integrated team in order to function as an efficient fighting force. Each element of the division must know its own job and exactly what to expect of every other element. Engineers must understand the infantryman's problems and perform the basic engineer mission of assisting the advance of the infantry and retarding that of the enemy. Infantry must understand the capabilities and limitations of the engineers and plan operations to utilize the available engineer support.

2. ORGANIZATION.—The organic engineer component of the infantry division is the engineer combat battalion with a total strength of 29 officers, 3 warrant officers, and 619 enlisted men (T/O and E 5-15, 31 October 45). The battalion consists of headquarters and headquarters and service company, 3 identical combat (lettered) companies, and a medical detachment (attached). Each lettered company consists of company headquarters and 3 identical (numbered) platoons. Platoons are further divided into platoon headquarters and 3 identical squads or working units. The platoon may be reinforced with equipment from company headquarters to perform missions beyond its scope.

Normally, it works on company missions under control of the company commander or independently on limited missions with its own tools and transportation. Its headquarters also supervises its 3 squads on limited decentralized tasks.

a. Battalion commander and staff.—The commander of the engineer combat battalion, a lieutenant colonel, has a dual role in the infantry division. Of course, he is a troop commander and directs the planning and execution of missions assigned to his unit; in addition, he is on the staff of the division commander and has the title of division (unit) engineer. As division engineer, he advises and assists the division commander and general and special staffs on engineer matters. He supplies the necessary engineer intelligence and recommends operations for his own battalion and attached engineer units (if any) in support of the tactical plan. The division engineer is also engineer supply officer for the division (par 3).

The division engineer has his own staff, including an executive oficer, S-1, S-2, S-3, S-4, and special staff officers. One of his principal assistants is the assistant division engineer (ADE) or liaison officer who heads the small engineer section at division headquarters. This captain keeps division headquarters informed on the engineer situation and keeps the engineer battalion informed on the division situation and plans. He also gives general assistance on engineer matters.

b. Unit engineers on regimental level.—Commanders of companies or platoons may serve as unit engineers when their commands are attached to infantry regiments. These engineer officers perform the same general functions for commanders of regiments as division engineers do for division commanders.

c. Attached engineers.—The combat battalion is designed to serve the "normal" engineering needs of the division, if the word "normal" can be defined. Often the single battalion is inadequate for the engineer tasks necessary to support an operation. For example in river crossings, the organic battalion must have the support of at least an equipage platoon from a treadway bridge company with its

70 assault boats and light equipage. This is necessary to handle even the assault-boat phase of the crossing. The usual prcedure in a major crossing is to place a corps combat group (including 2 or more combat battalions plus various bridging units to operate support rafts and install bridges) in support of a division, or to attach the group to the division (not to the divisional engineer battalion). The group handles the actual crossing, and the organic battalion is left free to give continuous support to the assault elements on the far shore. The attachment of this group does not affect the status of the commander of the organic engineer battalion as division engineer.

3. SUPPLY FUNCTONS.—As stated earlier, the division engineer is the engineer supply officer for the division. The fact that the division is not actually in the engineer chain of supply has a strong bearing on this duty of the unit engineer, who has three major supply functions.

a. Supply of engineer items.—The Corps of Engineers supplies several class II items, such as compasses, surveying instruments, slide rules, and similar equipment. Virtually all class IV items, fortification material, paint (except ordnance paint), nails, and the like, are a concern of the engineers. Normally, however, the engineer combat battalion does not actually handle these supplies. Requisitions of using units are approved or disapproved by the battalion supply section with S-4 fulfilling most of the division engineer's supply duties. S-4 notifies the using units when and where they can pick up the equipment from an army engineer supply depot or distributing point. In addition, S-4 often arranges for credits on class IV supplies at army supply points and allots them to elements of the division.

Normally, only local or captured materials, maps, and water are physically handled by division engineers. The division commander may order the supply section of headquarters and service company to set up and operate a supply point to distribute local and captured materials. However, using units must normally pick up and haul these supplies themselves.

b. Map supply.—Map supply is a primary responsibility of the Corps of Engineers. The supply of maps to the division is a function of the division engineer and is usually delegated to the battalion S-2. The ADE notifies S-2 of the division's map requirements and distributes the maps from division headquarters when they are received. Sometimes the ADE performs all the functions of map supply.

c. Water supply.—The supply of water to the entire division is a function of the division engineer. The supply section of the engineer headquarters and service company has four portable water purification sets, and more may be obtained upon proper authorization. These sets are usually operated separately, with one water point set up in each of the three regimental areas and the fourth held in reserve. The battalion S-4 performs the functions of division water supply officer for the division engineer and controls the operation of the water supply section. Water points are moved continually to keep abreast of the combat situation. The battalion S-4 keeps the division G-4 informed of their locations so that he may transmit the information to the troops. Using units send their own transportation to water points to pick up their water in 5-gallon cans or water trailers.

4. SUPPORT OPERATIONS IN GENERAL.—One principal mission of engineers is to give complete engineering suport to combat troops; thus, the combat battalion exists to assist the infantrymen of the division.

a. Normal asignment of units.—The battalion is normally kept directly under division control with its elements placed in support of major elements of the division. Often one platoon of engineers can efectively support an infantry regiment, and the other platoons of the company are used on other tasks as directed by the battalion commander (division engineer). Sometimes an entire company is required to support the regiment adequately. In either event, the principle of normal association of units is followed. This means that an engineer company is always assigned to support the same infantry regiment whenever this regiment requires

such support. If only one platoon of engineers is necessary, the same platoon is always drawn from the same engineer company. This habitual assignment develops mutual personal understanding from constant close association and is vitally important.

b. Support and attachment.—When the division is operating as a whole, the engineer element is normally placed in support. This means that control is kept by division headquarters through the division engineer. When the division is operating as combat teams, the engineer element is attached to a team and is under the direct control of the infantry regimental commander. Combat teams are usually employed in special situations, such as landing operations, when centralized control by division headquarters is difficult or impossible. Attachment of the engineers is common in such situations. In support and whenever possible in attached missions, engineer elements maintain communications with engineer battalion headquarters either by wire or radio, depending on the stability of the situation and the distance involved.

c. Location of supporting units.—The engineer platoon or squad in support of an infantry unit usually remains near the command post of the supported unit until assigned a job.

d. Removal and passage of obstacles.—Removing obstacles to the advance of the infantry or preparing passages is a major engineer function. Enemy mine fields must be removed or bypassed, a task normally undertaken by engineer troops. Each engineer combat company has nine electronic mine detectors in its organic equipment. It may have more as authorized special issue because detectors are frequently lost or damaged by rain or unavoidable rough treatment. Mine detectors are signal corps items and the division signal officer is responsible for repair and maintenance.

Detectors allow using troops to locate most of the metallic mines in a road block or mine field. However, remember that the engineer who has swept an area cannot guarantee that it is clear; he can say only that it has been swept. Infantry ammunition and pioneer platoons are also equipped with detectors and can sweep the area again if necessary.

Some obstacles can best be cleared by explosives. Each engineer combat company has 12 demolition sets, 1 in each of the 9 squads and 1 in each of the 3 platoon headquarters. These sets include all the blasting machines, blasting wire, galvonometers, crimpers, and other items necessary for normal demolitions. Each company carries a prescribed amount of explosives and blasting caps. Normal demolitions stocks are not enough for special missions, and additional materials must be obtained to meet extraordinary requirements.

Pioneering is often required to remove such obstacles as abatis, blown culverts, soft ground, and the like. In its standard equipment, each engineer company has several pioneer sets containing picks, shovels, hammers, saws, wrecking bars, drills, and other essential tools. These are always available to working units. Working units also have nails, spikes, rope, and related items.

Each of the three lettered companies and headquarters and service company of the combat battalion have a truck-mounted air compressor with attachments. These include wood and rock drills, compressed-air-driven saws, and jackhammers. Each company also has gasoline-powered chain saws. These tools eliminate much hand labor and save time.

e. Erection of obstacles.—Engineers not only remove enemy-placed obstacles, but construct obstacles to delay or stop the enemy. Demolitions and pioneering operations are important in this work and the engineer equipment mentioned above is especially useful.

f. Routes of communication.—Another vital engineer task is the construction, improvement, repair, and maintenance of routes of communication. Since all such work performed by the division engineers is hasty or expedient in nature, the pioneer equipment discussed above is used to perform most of this work. Repair and maintenance of the road net in the division area is always a problem and has a high priority among engineer tasks. Corps engineer units take up the task behind the division rear boundary and sometimes work well forward in the division area. These corps units are often attached to the division to relieve the organic engineers for work necessary to support the assault troops.

g. Bulldozer.—The bulldozer has not been mentioned during the discussion of the various engineer tasks, but it is used in all of them. Each engineer combat company has one, but headquarters and service company does not. No single piece of engineer equipment has attracted more attention and gathered more colorful fame than has this tractor, crawler-type, with angledozer, to cite the technical nomenclature. It is perhaps the most useful piece of equipment the combat battalion has and it plays an important role in

FIGURE 53.—Engineer bulldozer clearing the way for tanks and artillery vehicles.

almost all missions performed in support of the infantry. Its uses are innumerable and its ability to help the fighting man is now legendary. The bulldozer is a rugged, commercial type piece of equipment which is adapted to military use. It is usually powered by a diesel engine. A cab of armor plate can be placed on it to protect the operator from small-arms fire and shrapnel. A dozer blade is also mounted on a standard medium tank to produce a heavily armored tankdozer. (See Figures 53 and 54.)

The supporting wheeled or tracked weapons and supply vehicles must closely follow attacking infantry. This means that roads must be kept clear of obstructions. When roads are blocked by the enemy's planned obstructions and destructions, the bulldozer plays what is perhaps its greatest role. Bulldozers can quickly push or tow aside fallen trees or elaborate log, timber, or rail and concrete blocks which block defiles. They can fill craters or move huge slides of rock and earth caused by enemy demolitions in cuts and in mountainous areas. Bulldozers often eliminate the need for replacing destroyed bridges across rivers or dry chasms, especially during dry seasons. Bulldozers can construct bypasses by simply cutting and pushing the stream banks into the stream bed, thus building a road to replace a bridge. A culvert can often carry the small volume of water during the dry season.

FIGURE 54.—M-4 tank with dozer blade crashing log road block.

Sometimes the infantry attacks over terrain where no suitable roads for military traffic exist. Bulldozers can convert trails to roads or widen existing roads.

In attacks through towns, villages, and cities where heavy concentrations of artillery or bombing must be used, the advance is slowed by rubble which blocks streets. Bulldozers can push aside this rubble and make the streets passable for all types of vehicles.

Antitank ditches sometimes delay or halt all vehicles. Bulldozers can knock down the sides of a ditch or fill a section wide enough for a roadway.

Fast moving attacks knock out enemy vehicles, horses and carts, and armor which block roads. Here again the bulldozers clear the way.

Bulldozers have been used in attacks on fortified positions to push earth and rocks over firing ports of pillboxes and similar positions and bury the enemy alive in his gun pits.

In defensive operations, tanks or tank destroyers must often be placed in forward positions exposed to enemy fire. Bulldozers can eliminate much of the risk by digging hull-down positions for the armor.

These are only a few examples of how the bulldozer is used to support the infantry. These machines are ideal for any operation requiring the movement of quantities of earth for short distances, or a strong pushing or pulling force.

5. DEFENSIVE OPERATIONS.—Engineer tasks in a defensive situation fall into three categories: construction of obstacles, maintenance of routes of communication, and combat.

a. Obstacles.—(1) *Mine fields.*—Plans for the laying of mine fields are coordinated by the division G-3, the division engineer, and the commanding officer of the regiment in whose area the fields lie. Normal engineer support is not enough for executing all of these plans. Infantry units must utilize their ammunition and pioneer platoons to assist the engineers in placing mines in fields that are a division responsibility. Normally the engineers furnish technical advice and some assistance to infantry battalions in placing local mine fields. Responsibility for proper recording of the mines is fixed before the operation begins.

(2) *Wire.*—Erecting wire obstacles is another engineer task requiring infantry assistance. Infantry reserve units frequently furnish carrying parties and front-line units normally furnish erection parties. Engineers take charge of

the operation and provide technical assistance. The location of the wire obstacle is determined by the infantry commander with the concurrence of the engineers on technical aspects of erection.

(3) *Road blocks.*—Construction of road blocks normally falls entirely to engineers because of the technical knowledge and special equipment required. The blowing of craters, felling of trees, demolition of buildings, and similar tasks call for engineer equipment and methods. Engineer units may also be assigned to construct and defend a part of a division or corps barrier system until relieved.

b. Routes of communication.—During defensive operations, road nets carry abnormally heavy traffic, producing unusual maintenance problems. This is particularly true for roads immediately behind the strongest positions. During unfavorable weather, these roads may quickly become useless unless engineers perform continuous road maintenance. Sometimes new roads are necessary.

It is obvious from the number and extent of these tasks that the divisional battalion cannot provide enough engineer assistance in many situations. Road maintenance, as well as other tasks, may be taken over by corps engineer units placed in support of the division.

c. Combat in defense.—Finally, engineers participating in a defensive operation may be ordered to take over and defend a portion of the line. Engineer equipment, weapons, and service personnel are not enough for such a mission and must be augmented by trained personnel from infantry units. Since engineer units have no mortars or antitank guns, these must be provided along with artillery and cannon company forward observers. Sound-powered telephones, telephone wire, radios, and other communications equipment must be added to their organic equipment. The evacuation of casualties requires additional litter bearers, ambulances, and other aid facilities.

If only one company of engineers is to be used as infantry, these facilities can best be provided by attaching it to an infantry battalion.

6. RETROGRADE MOVEMENTS.—Preparation for a retrograde movement is closely allied to any defensive operation. When available, division engineer troops prepare demolitions (bridges, abatis, craters, and the like), construct emplacements along new lines of resistance, erect barbed-wire entaglements, and lay mine fields. Definite responsibilities are fixed before accomplishing demolition missions. When the proposed or anticipated movement is through hostile territory, prepared demolitions may have to be guarded. However, the bulk of the preparations for a retrograde movement cannot be done by division engineer troops as it is necessary for them to be with the front-line troops. Most of the work must therefore be assigned to supporting engineer units from corps and army.

7. ATTACK AND PURSUIT OPERATIONS.—An attack may be launched from a defensive position built up over several weeks of position warfare and may become a fast-moving pursuit operation. Such a situation requires the full capabilities and efforts of division engineers.

a. Initially encountered obstacles.—For example, assume that the enemy has placed mine fields, barbed wire, and pillboxes in the path of the friendly advance. If two regiments are attacking abreast, each with two battalions forward, two platoons of engineers may be placed in support of each assaulting regiment. An infantry battalion normally requires two gaps in the wire and mines, a task falling to the supporting engineers. The mines may be detected by probing or prodding, and either marked or removed. Gaps are marked with tracing tape or some other suitable means.

Demolition of wire and pillboxes is usually performed by infantry troops. Engineers prepare the charges and instruct the assault troops in their use. Engineers themselves breach such special obstacles as dragons teeth or other deliberate antitank devices. Corps or army engineer units usually are assigned the job of destroying pillboxes or field fortifications after the attack has passed through them, to prevent the enemy from reoccupying them.

b. Delaying obstacles.—After the attack has breached the deliberate defenses, the engineer mission normally is to remove the delaying obstacles prepared in depth by the enemy.

Delaying obstacles may be mines, timber cribs or demolished roads and bridges, posts, craters, abatis, destroyed vehicles, or rubble produced by destruction of buildings. An engineer platoon can usually handle any of these obstacles as soon as small-arms fire stops. This work is normally done automatically by the engineers concerned.

The engineer unit ordinarily can bypass or reconstruct demolished culverts and small bridges, but bridging equipment must be made available by the division engineer for the crossing of large chasms or streams. The division engineer and his staff furnish or obtain additional equipment and personnel for any situation beyond the scope of the unit on the spot.

c. Combat.—Engineer troops are rarely ordered to attack as infantry, because they are more valuable when employed as engineers than when used as riflemen. However, if they are committed to the attack, engineer units require additional communications, fire support, and evacuation facilities, just as they do in the defense. Remember that engineer units have heavy type automatic weapons (18 Cal. .30 HMG and 15 Cal. .50 MG) which are unsuitable for attack operations. The engineer company has no Browning Automatic Rifles. An attack by engineers, therefore, is confined to limited objectives to allow forward displacement of the heavy machine guns for continuous support.

8. ASSAULT CROSSING.—Division engineers play a major part in river crossing operations, except when a river such as the Rhine presents a major barrier. In large operations, assault troops may be crossed by corps and army engineers; division engineers cross as passengers to give immediate close support to the infantry on the far shore.

a. Crossing operations.—If equipment is available, division engineers can ferry assault troops across water barriers in assault boats and then construct footbridges, However, supporting corps or army engineers must construct ferries and high-capacity bridges.

FIGURE 55.—Bailey bridge such as the one shown above can be rapidly constructed by supporting engineer units.

b. Reconnaisance.—Detailed joint reconnaissance by participating engineers and infantry is usually made before any crossing is attempted. Reconnaissance parties composed of troops from the normally associated infantry and engineer units patrol on the far shore of the water barrier. Similarly, the engineer platoon leader who will handle the boats for Company A, 4th Infantry, reconnoiters the river site with the commanding oficer of Company A, also, the sergeant who will supervise the construction of a footbridge for Company D should be closely associated with the commanding officer of that unit.

Engineer carrying parties may need help to get boats and bridging materials into the assembly area and from there to the river banks. This help should be given freely from reserve and service units of the infantry.

c. Planning.—It is best if supporting engineer units can participate in all planning on the regimental and battalion level, just as the division engineer is consulted on the division level.

d. Priorities.—Engineer equipment such as bulldozers and reconnaissance vehicles must have a high priority for crossing bridges.

9. SUMMARY.—The engineer combat battalion of the infantry division is organized, trained, and equipped as a vital supporting arm. Its mission is to assist the advance of the division in all phases of any attack and pursuit operation and to obstruct and delay the advance of the enemy in any defense operation. Its capabilities are many and its limitations are those imposed by time, equipment, and strength in personnel.

It does construction work quickly and excels in expedient methods of doing jobs instead of constructing permanent structures, when these methods meet the requirements of the situation without wasting effort and supplies.

To sum it all up, the engineer combat battalion is a versatile unit ready and able to perform any of the many vital tasks the infantry division requests.

CHAPTER 6

Tank Principles Don't Change

Success in battle can be assured only when there is complete cooperation of all arms—this is especially true of infantry-tank action. Since tanks and infantry are linked so closely together, it is necessary that the doctrine, powers, and limitations of both be understood by all. Successful infantry-tank action requires careful planning, coordination of all available means, and above all, close cooperation. In visualizing the planning, coordination, and cooperation necessary between the tanks and infantry, it is well to note that tankers are the only soldiers other than infantrymen who close with the enemy.

The lessons learned in infantry-tank employment in World War II consist primarily of correcting the idea, stimulated by the rapid German capture of France, that tanks alone could overrun an enemy and win battles. In fact, few *new* lessons were learned during World War II; rather, lessons already learned had to be relearned. In an article in *The Mailing List*, 1935, Capt. Joseph J. Gutowski describes the action of the 3d Platoon, Company A, 301st Tank Battalion, 26-29 September 1918. At the end of that article the author listed the lessons learned by Major Harrison, the battalion commander.

> 1. Joint infantry-tank training prior to actual combat is necessary in order to insure maximum cooperation and confidence.
> 2. Success can be obtained only when there exists close and continuous liaison between tanks and infantry.
> 3. Tanks without infantry support may be able to capture a position but are incapable of holding it. Infantry must move in on the heels of the tanks to mop up and hold the position.

4. Although the tanks support the infantry, infantry must clearly understand that the combined attack is a fifty-fifty proposition and requires mutual cooperation. The infantry must also support the tank action, particularly by locating antitank weapons, informing tank crews of their locations, and destroying these weapons when it is within it's power to do so.

5. Smoke screens under favorable conditions facilitate tank action, and offer considerable protection against antitank weapons.

6. Whenever it is possible to do so, tank commanders as well as tank platoon commanders, should reconnoiter the area over which they are to operate.

Add to the lessons learned by Major Harrison in 1918, the necessity for artillery in close support of the infantry-tank team, and the need for improved communications and liaison brought about by faster tanks and faster moving situations and you have a fairly complete picture on the latest doctrine on employment of tanks in support of infantry. In spite of the experiences in World War I, tank-infantry cooperation was practically non-existant at the beginning of World War II. Tank units had not trained with the infantry units with which they fought; in fact many tank units had not trained with any infantry unit; few commanders really understood the capabilities and limitations of tanks; communications and liaison between tank and infantry units was far from adequate.

It soon became evident that tank-infantry coordination and cooperation was vital. Steps were taken to achieve this coordination, and both tank and infantry units worked out Standing Operating Procedures (SOP) which they followed. These SOPs varied in some details, but all of them provided for close coordination between the tanks and infantry.

First, the question of liaison was worked out. Tank units placed a liaison officer at the CP of each unit with which it was working. Since these officers were not provided for in the TO/E, platoon commanders often acted as liaison

officers and the platoon sergeants led the platoons. These liaison officers were equipped with a tank type radio that could communicate with any of the tanks. The liaison officer, then, not only acted as an adviser to the supported unit commander, but he also relayed instructions and orders to the tanks and kept the supported unit commander informed at all times as to the location and situation of the tanks.

Later, SCR 300 radios, operating in the infantry net, were carried on the command tanks. This enabled infantry commanders to communicate directly with the tank commanders, but since the radios were carried in boxes on the outside of the tanks, it also enabled the Germans to readily identify the command tanks. Next, an AN/VRC3 radio was installed in each command tank. This radio is identical to the 300 series radio except it is mounted in the tank and operates off the vehicular electrical system instead of dry batteries. These radios were calibrated with infantry radios prior to the attack. Direct contact between the infantry and the command tanks was then possible.

Concurrent with improvements in infantry tank liaison and communications came a change in the ideas relative to tank employment. During training, tank units had been taught that they would always employ mass; the battalion was considered the smallest unit that would be committed. In addition, tank units were taught that they would be employed only when the terrain was favorable for tank employment. It was necessary to modify these two ideas early in the war. For example, in Italy the terrain was rarely favorable for tank action. Seldom could more than a company be employed usefully, and often a platoon was all that could be committed due to the restricted terrain. In spite of unfavorable terrain, tank units were employed successfully in small numbers. Tanks usually took part in all attacks if the terrain was traversable even by a small number of tanks.

However, the successful use of tanks in small numbers does not change the fundemental rule that tanks are most effective when employed in mass. It merely shows that

when terrain is not suitable for mass employment, tanks can be of tremendous assistance to the infantry when employed in small numbers. Probably the most common breakdown of tanks in forming the infantry-tank team was one company of medium tanks to an infantry regiment. In some units, tanks were habitually used in mass. Major General Livesay, commanding 91st Infantry Division stated: "I use my tanks in mass support of the unit making the big effort."

As the war progressed, infantrymen became more conscious of the capabilities and limitations of tanks and began to aid tank employment by noting all terrain suitable for tank action and by locating and destroying antitank guns; as they advanced they informed the tankers of any trails or avenues of approach which would enable tanks to support the action. In addition, as the infantry became tank conscious, patrols would bring back information of the terrain valuable to tank unit commanders. Infantry units soon realized that it was to their advantage to destroy concealed antitank guns as a knocked-out tank was of no further use to them. In short, the tankers became aware of the problems confronting the infantry, and the infantry became conscious of the problems confronting the tankers. Both worked together to overcome the limitations of the tanks and infantry.

Another step that was taken early in the war which facilitated the employment of tanks with infantry was the policy of habitually attaching a tank unit to the same infantry unit. Although this appears to be a simple and logical step, early in the war tank units would work with eight or ten different divisions during a single month. Naturally coordination with numerous different units was extremely difficult. Finally, a tank battalion was attached to an infantry division and left with that division for a period of time. For example, when the 3d, 45th, and 36th Infantry Divisions landed in Southern France in August 1944, each had an attached tank battalion. These battalions fought with these divisions until the end of the war. Soon the tank officers knew the infantry officers by name. By

fighting together over a period of time, mutual respect and confidence was fostered between the units. The tank unit considered itself part of the infantry unit, and the infantry unit considered the tank unit its own. Not only was coordination acheived, but liaison was also greatly simplified; both units knew the SOPs of the other and what to expect under a given set of circumstances.

Both from a training and coordination viewpoint, the soundness of this policy has been empasized by tank unit commanders and infantry commanders. Lt. Col. Beggs, G-3, 88th Inf Division stated: "It is my belief that when it is practical, no operation should be undertaken in which tank are used without first giving the infantry and the tank unit a chance to work together before going into action. Combined training is a prerequisite to the success of an infantry-tank operation." Lt. Col. Martin, G-3, 34th Division stated: "Combined training is a prerequisite to the success of an infantry-tank operation. It cannot be expected that infantry, knowing that armor draws enemy fire, will work successfully with tanks without being familiar with them. At the crossing of the Rapido River, The 168th Infantry Regiment forced a successful crossing due to the excellent coordination between infantry platoon and tank platoon. Again, during the crossing of the Rapido River, the 168th Infantry Regiment forced a successful crossing due to the perfect coordination between the regiment and the 756th Tank Battalion which supported it. These units had had an opportunity to work together before going into action."

Along with the revised doctrine of employment of tanks in small numbers in restricted terrain, came the appreciation of direct fire support when terrain prohibited tanks from overrunning an objective. This was particularly true in Italy where the mountainous terrain prohibited positioning tanks where they could bring direct fire to bear on the enemy held positions. When the situation dictated, tank liaison parties carrying pack radios would accompany the infantry. These parties could then direct the fire of the

tanks against any objective the infantry requested. This procedure eliminated hitting our own troops, since the liaison party accompanying the infantry knew the exact location of all the infantry elements.

The value of fire support was best illustrated, perhaps, by the 756th Tank Battalion supporting the 34th Infantry Division during the crossing of the Rapido River north of Cassino, Italy. The Germans had strengthened their positions by daming the river north of the position thereby sluicing the water over the lowlands bordering the river. The area became a quagmire which prevented tanks from crossing. However, the tanks were positioned where they could fire across the river, and tank liaision parties accompanied each infantry battalion. These parties very effectively directed tank fire against enemy pillboxes and machine gun positions across the river that were bringing fire to bear on the infantry. This action also illustrated the employment of tanks over terrain that was exceptionally poor for tank operation. In spite of the flooded area, tanks attempted to traverse the lowlands and most of them were immobilized in the quagmire. With engineer assistance a few tanks succeeded in using an old road to cross the lowlands and the river but not in sufficient numbers to blast down enemy fire. They were soon lost, but before they were knocked out they rendered valuable assistance to the infantry by neutralizing pillboxes and by clearing paths through the antipersonnel minefields along the river line. Later, by going north of the sector moving along a dry river bed, sufficient tanks crossed the river to beat down the enemy fire and allow the infantry to mop up and organize the position. The entire action took place over terrain unsuited for tank operations. (See figure 56.)

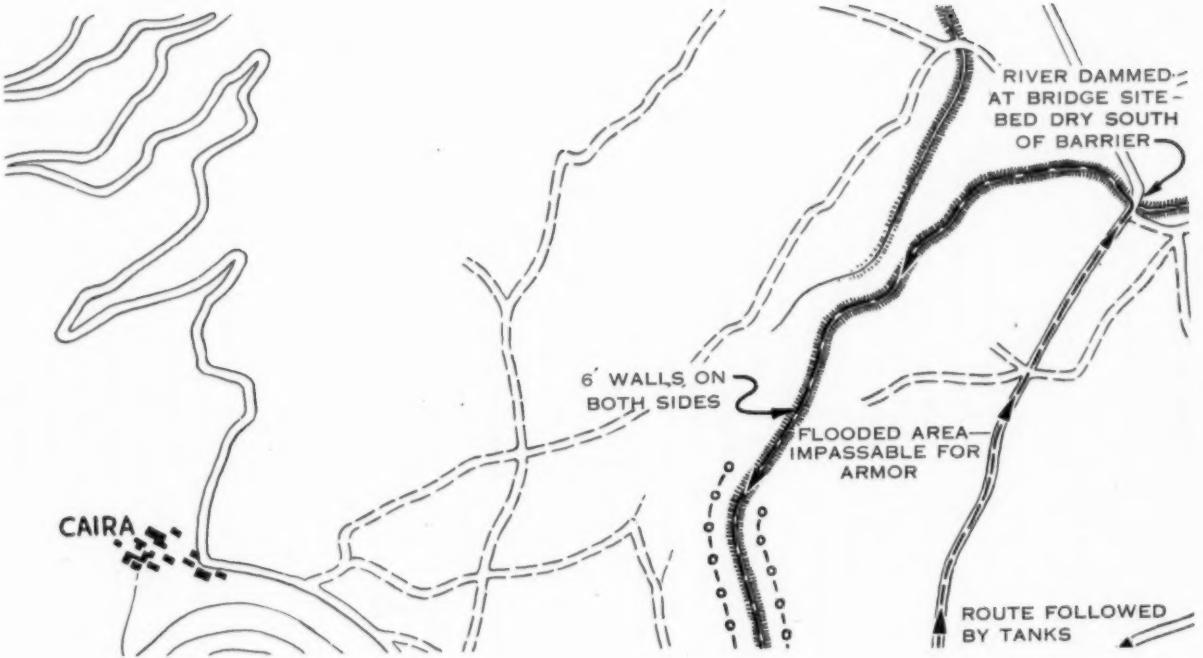
The detailed preplanning, coordination, cooperation, and rehearsal necessary to a large scale infantry-tank operation was best illustrated during the breakout of the Anzio beachhead in Italy. Before the operation began, the infantry and tank units that were to work together rehearsed the operation behind the lines. Each platoon not only knew

exactly what its mission was, but also knew exactly who it was to work with. The success of that operation proves the value of this type of preparation whenever time permits.

Thus far we have dealt with the employment of tanks with infantry during relatively stable situations as this is the normal situation for separate tank battalions. However, during pursuits, tank battalions were usually teamed with elements of infantry divisions to form fast moving spearheads to precede the division. This type of operation is similiar to the operation of a combat command of an armored division. The principle differences are that the infantry is not motorized and communication equipment is not adequate to control the task force. Special arrangements therefore are necessary. One satisfactory solution to the problem is to mount infantry on the tanks and thus utilize the longer range of the tank communications. Care must be exercised, however, to maintain the tactical integrity of the tank and the infantry units.

After crossing the Rhine, the 45th Infantry Division and the 191st Tank Battalion employed this type of task force almost continuously. An infantry company and elements of the heavy weapons company were mounted on each tank company. The infantry company commander rode on the tank company commanders tank; the infantry platoon commander rode on the tank platoon commander's tank. One light tank platoon was attached to each medium tank company, and one infantry squad rode the last three tanks of the light platoon. The two lead tanks of the light platoon did not carry infantry.

All orders were transmitted over the tank communications net. Each infantry company understood that they worked with the tanks on which they rode. This force was normally employed in one regimental sector along one or two roads. When opposition was encountered, one of the infantry and tank company groups engaged the enemy. While they were mopping up, a second group passed through them to continue the advance. This prevented the enemy from organizing any effective defense. The task force had, in addition to the tank battalion assault gun platoon, a battery of


RIVER DAMMED AT BRIDGE SITE - BED DRY SOUTH OF BARRIER
6' WALLS ON BOTH SIDES
FLOODED AREA — IMPASSABLE FOR ARMOR
CAIRA
ROUTE FOLLOWED BY TANKS

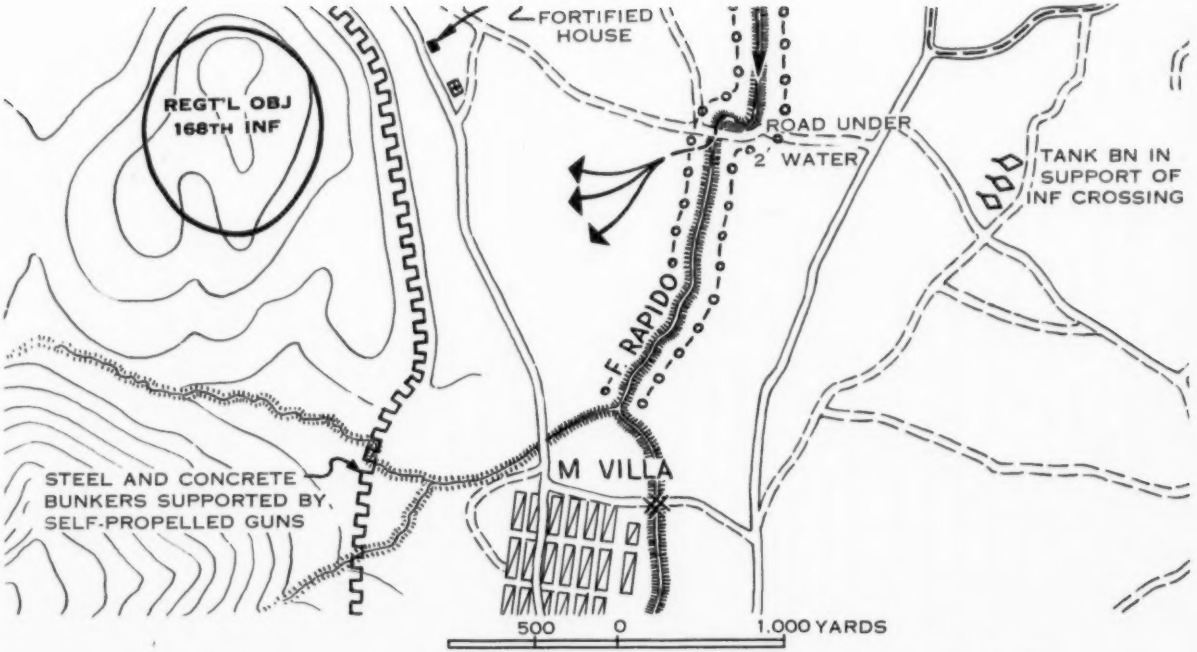

FORTIFIED HOUSE
REGT'L OBJ 168TH INF
ROAD UNDER 2' WATER
TANK BN IN SUPPORT OF INF CROSSING
F. RAPIDO
M VILLA
STEEL AND CONCRETE BUNKERS SUPPORTED BY SELF-PROPELLED GUNS
500 0 1,000 YARDS

FIGURE 56.—Map showing tank action in support of 168th Infantry after crossing Rapido River.

artillery or the cannon company of the infantry regiment, and a platoon of engineers. The engineers had one or more tank dozers to remove tree blocks and to fill road craters. The tank battalion sent a half track with a SCR 193 or SCR506 radio to the regimental command post to maintain liaison and communication with the task force. Normally, the other two battalions of the regiment followed as closely as possible, mopping up by-passed resistance and taking over prisoners left by the spearhead.

It is evident then that the lessons learned concerning the employment of armor during World War II closely parallel those learned in World War I. Successful infantry-tank actions require prior joint training, infantry-tank reconnaissance, preplanning, proper means of control and communications, mutual confidence, coordination, and above all, cooperation between the tanks and infantry.

CHAPTER 7

"Powerhouse I"

This is the story of a river crossing; specifically, the crossing of the Meurthe River in November 1944 by the 3rd Infantry Division. This river is located along the western base of the Vosges Mountains in the east central part of France. The crossing is worthy of study because certain aspects of it were unique, and adherence to the accepted doctrine paid valuable dividends. Particular emphasis is placed on the role of the engineers in the discussion of this operation.

The 3rd Division operating as a unit of the 7th Army had driven north and east some 400 miles since landing on the shores of Southern France in August 1944 and was now confronted by the vaunted Vosges Mountains. To make things more difficult, the enemy had methodically destroyed all of the bridges across the Meurthe river which had to be crossed before the Vosges could even be tackled. Prospects for the winter at hand were not too rosy. Already snow had fallen and temperatures were going lower each day. All indications pointed to a cold wet winter with prolonged fighting in heavily-forested mountains. Then too, enemy resistance had stiffened considerably in the preceding few weeks and possession of every inch of ground was being hotly contested.

As soon as possession of the west bank of the Meurthe River was assured, the commanding general of the 7th Army's VI Corps assembled his division commanders at Grandvillers, France on 10 November 1944. He outlined the corps mission of attacking east through the Vosges Mountains from the St. Die area, capturing Strasbourg on the Rhine, and destroying the enemy in the corps zone west of

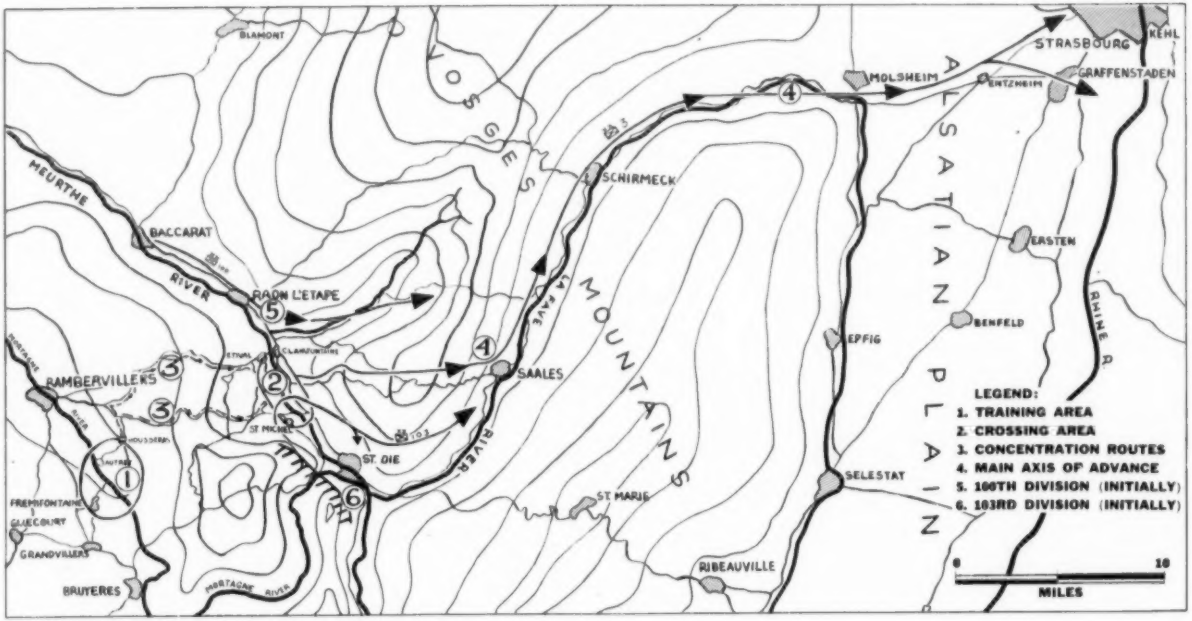


FIGURE 57.—Map showing area where 3rd Infantry Division crossed the Meurthe River.

the Rhine. The corps commander presented three plans, all of which called for an assault crossing of the Meurthe River by the 3rd Division. Plan "A," which was finally executed, called for the 3rd to force a crossing and proceed due east and then northeast on the axis Saales-Schirmeck-Strasbourg, with the 100th Division on its left and 103rd Division on its right, following an administrative crossing of the 103rd behind the 3rd and subsequent passage through the 3rd's right to the south and southeast. November 20th was established as the tentative date, contingent upon the progress of the 100th Division who were operating southeast from Baccarat on the 3rds left, and 103rd who were attempting to capture the heights overlooking St. Die on the 3rds right. Successful progress in these actions would deplete enemy reserves and thus weaken his defenses in the zone where the 3rd was to cross. (See figure 57.)

Concurrently with this initial conference, the 103rd was in the process of relieving the center and right regiments 30th Inf. and 7th Inf.) of the 3rd Division. When relieved, these two regiments and their combat team attachments (except artillery) were to assemble in the area of Autrey-Fremifontaine-Sainte Helene to undergo brief training in river crossing. The remaining regiment of the 3rd Division (15th Infantry) was occupied in clearing the enemy from the west bank of the Meurthe as far north as Clairfontaine and in making preparations to cover all friendly activity west of the river incident to the crossing.

THE DIVISION PLAN

Armed with information obtained at corps headquarters, Major General John W. O'Daniel, commanding general of the 3rd Infantry Division, returned to his headquarters where he initiated staff studies and preliminary preparations for the crossing. He placed special emphasis on reconnaissance of *both* sides of the river and on exhaustive engineer reconnaissance of the entire river in the division sector.

Two days later the division commander formulated his plan, designated Powerhouse I. He decided to force a crossing about 2000 yards north of St. Mihiel. Several factors

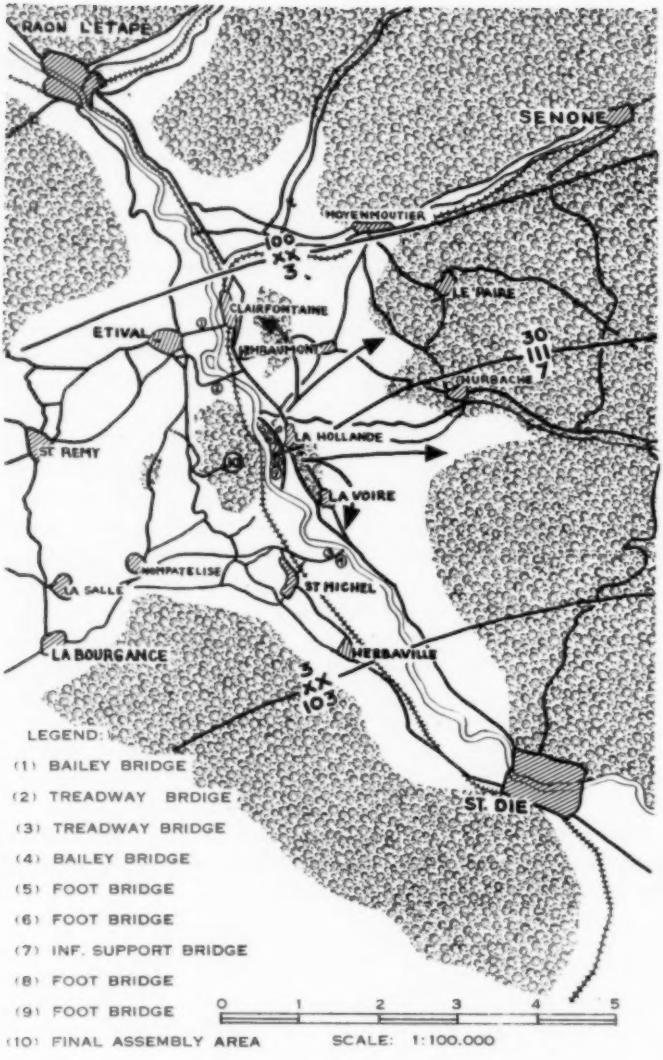


FIGURE 58.—Detail map of crossing area of 3rd Infantry Division.

strongly influenced this choice: first, there was an adequate road net leading to this area from the west; second, the railroad at this point, as well as providing a well defined reference line, was immediately adjacent to the river thus providing good cover; third, this site provided excellent terrain on the friendly side for the emplacement of direct fire supporting weapons; fourth, this site possessed wooded areas which would provide adequate assembly areas close to the river for both men and equipment; and last, and of utmost importance, early reconnaissance of the enemy side of the river had established the fact that the enemy was not holding his bank of the river at this point. Instead, because of the broad half-flooded plain at this point and miserable cold wet weather at this time of the year, his defensive position was based on the buildings along the Raon l'Etape-St. Die highway some 800 to 1000 yards east of the river. This fact would permit a bold and audacious plan. In addition to designating the crossing site, the division commander indicated that the 7th Regiment would cross on the right and the 30th on the left. Based on the fact that the enemy did not hold the far bank, a crossing by stealth was conceived. *The attack would jump off from a line of departure 300 to 500 yards west of the enemy's main line of resistance on the enemy side of the river!* To carry out this plan it was decided to effect the main crossing by footbridges. Each of the two asasult regiments was to provide two assault platoons who would cross the river in assault boats. Their mission was to seize the line of departure and in addition, cover the construction of four footbridges, two in each regimental crossing sector. As soon as the footbridges were finished the bulk of the two regiments would cross to launch the attack. The plan was certainly unique—its test would soon come. (See figure 58.)

The answer to one question was essential to success of the plan, would the river stay high enough to prevent the enemy from occupying the valley bottom or would it recede enough so that he could reoccupy it? Only an infallible weatherman and the enemy could answer that question.

DIVISION ENGINEER PLAN

Now let us consider the engineer plan for this operation. Thus far we have seen that four footbridges were to be constructed. In addition, enough boats were needed initially to cross four assault platoons. However, additional boats must be provided to cross all troops in the event of failure to establish footbridges. This was a distinct possibility inasmuch as the Meurthe was in a receding flood stage at this time. On November 11 the river had been completely out of its banks; additional rain would certainly send it out of its banks again. The current was excessive for footbridges (6 to 8 m.p.h.). It was further agreed that one infantry-support bridge (maximum capacity 6 tons) would be constructed in the footbridge crossing zone. This bridge would permit the pasage of light vehicular traffic across the river before the heavier bridges could be completed. In addition to this light bridge it was decided that 4 class 35 bridges would be built; two at St. Michel, one at Clairfontaine, and one just south of Clairfontaine. Trouble was anticipated at all of the heavy bridge sites, for the soggy condition of the ground necessitated that heavy bridges be built on or near existing bridge sites where the existing roads could be utilized. This meant that the bridge sites would not be secured in the initial crossing—but that they would have to be captured before heavy bridge construction could be started. This assured us of the old problem of building a bridge on well defined enemy registration points.

The engineer plan called for the 3rd Division engineers (10th Engineer Combat Bn.) to cross the assault platoons in boats and then to construct the four footbridges. Construction of the light infantry support bridges, as well as the four heavier bridges would be handled by the 1st Battalion, 36th Engineer Regiment plus two additional companies from this same fine unit.

Now let us see what happened to the 7th Infantry and the 30th Infantry Combat teams (less arty battalions) after they were relieved by the 103rd Division. As scheduled, they assembled in the previously designated area for a five day

training priod. Full emphasis was placed on engineer training in assault boat operation, footbridge construction, and proper method of crossing footbridges. Half of the training was conducted at night. Rehearsal crossings were staged on the Mortagne River, which had characteristics similar to the Meurthe. This training paid dividends in the final crossing.

By November 16, most details of the plan had been worked out to a high degree of perfection. The 15th Infantry Combat Team had accomplished its mission and had a firm hold on the west bank of the Meurthe; the 100th and 103rd Divisions were making good progress. It was time to concentrate forward. The road net leading east from the training area would permit each assault regiment to move to the river line on a separate route. During the three nights prior to D-Day, the regiments were directed to infiltrate forward to the river line and emplace their direct fire weapons. Also during these three nights, division and corps artillery units were to make changes in their position areas so that they could support the attack. The division engineers and supporting corps engineers would move forward to well concealed areas, bringing essential bridging equipment with them. The infantry personnel were to move by truck during the night of D-1 to detrucking points 3 miles west of the river. Once there, they would move to the river and make the initial crossing. During this same three day period, to confuse the enemy as to the date and time of attack, the artillery was ordered to increase its harassing fires on the division front and to fire 15 minute pre-daylight and after-dark missions every day.

ORDERS CHANGED

On Nov. 18th when the stage was all set, orders came from VI Corps Headquarters stating that because of the excellent progress being made by the 100th Division on the left, the 3rd would not have to force the river. Instead, the 3rd Division would pass through the 100th and exploit its success. This brought about an immediate cancellation of the 3rds concentration plan and required the assault regiments

to reconnoiter forward assembly areas in the zone of the 100th Division. Orders for this movement, to take place during the night of November 19-20, were issued. Early on the morning of the 19th November however, the VI Corps commander informed the 3rd Division commander that the progress of the 100th Division had been considerably retarded and that resistance was piling up in front of them. Consequently, the 3rd Division would cross as originally planned—*this change just a few hours before H-Hour!* Could it be done on such short notice? The remaining hours would be fully occupied by the resumed forward concentration. Most originally planned preparations were completed without incident. However, it was impossible to emplace all the direct support weapons and smoke generators in position to support the attack as planned.

In the meantime the 15th Infantry regiment had managed to cross one platoon on the night of November 18 in the zone of attack of the 7th Infantry. This platoon occupied a house directly in front of the enemy's main line of resistance and were undetected! After reporting this accomplishment by radio, the platoon was ordered to stay in its position and continue sending radio reports. This platoon rendered valuable service in the next 24 hours. They reaffirmed that the enemy was still holding along the Raon l'Etape-St. Die highway. On the night of November 19th, the platoon was ordered to patrol back to the river line and contact the footbridgehead assault platoons when they arrived on the far bank. This operation was completely successful and undetected by the enemy.

Commencing immediately after dark on 19 November, the four footbridge assault platoons crossed successfully, and work began almost immediately thereafter on the footbridges. By 2400 the four footbridges were completed and the four assault platoons were in possession of the line of departure. Foot elements of the assault regiments proceeded from the detrucking area to the footbridges without incident and began moving across. By 0600, all battalions of the 30th Infantry and 2 battalions of the 7th Infantry were on the line of departure ready to go—and still undiscovered!

A bold plan was paying off. At 0615 the fire preparation was initiated. Because the enemy had been subjected to similar artillery concentrations on preceding days at this time, he was still unalerted. The combined fire of division and corps artillery, tanks, and tank destroyers, AAA multiple batteries, chemical mortars, and organic infantry weapons placed devastating fire on the enemy position. This fire continued for 30 minutes, shifting at 0645 to the flanks of the assault regiments and lifting to the enemy's rear areas. As soon as these fires were lifted the assault regiments crossed an extensive antipersonnel minefield which exacted approximately 150 casualties, and pounced on a bewildered and dazed enemy. His initial positions were overrun almost immediately. Only after the first demoralizing shock of the assault was over was he able to bring his weapons into play —and then with only moderate effect. By 1200, 20 November the 7th Infantry had captured La Voivre and had proceeded 2300 yards east. During the same period the 30th Infantry captured La Hollande and Himbaumont, and were assaulting Clairfontaine.

BRIDGING THE RIVER

Now let's go back to the engineer picture and see how it developed. Shortly after the attack jumped off against the enemy's main defensive position, enemy mortar fire was brought to bear on the footbridge crossing area. However, the light infantry support bridge in this area had just been completed by that time. Soon the bugaboo of rising water would have to be fought for rain was falling again. At the heavy bridge sites all of the expected difficulties were encountered. Early detailed reconnaissance on the Clairfontaine sites was made impossible by accurate mortar, artillery and small arms fire. Remember that as yet no friendly troops occupied the ground where the east ends of the bridges would finally rest. Accordingly, smoke, which until now had been of little value because of shifting winds, was increased. Generators and smoke pots were supplemented by chemical mortars which gave a much more effective screen. Initially, these difficulties were not encountered at

the St. Michel sites, and bridge construction was started there on a Bailey Bridge at the old site and a Treadway Bridge almost 100 yards north of it. Shortly thereafter, however, accurate artillery fire on these sites forced cessation of construction for several hours. By late afternoon on 20 November the infantry had made sufficient progress so that construction could be resumed. Enemy artillery had been forced to displace to the rear and Clairfontaine had been cleared of all enemy troops except a few snipers. Work was intensified during the night. By 0645 on 21 November the Treadway Bridge at St. Michel was completed. However, after only 37 vehicles (about half of them tanks and tank destroyers) had crossed, the bridge had to be abandoned because of rising water. In the meantime the 103rd Division was crossing on the four original footbridges which were becoming increasingly difficult to maintain in the rising flood. The assault bridge in the footbridge area was still crossing considerable light traffic. By 1000 the Bailey Bridge at St. Michel was completed. Two and one-half hours later sufficient vehicles of the 3rd Division had crossed over it and the bridge was turned over to the 103rd Division. By 1330 that same day the main Clairfontaine bridge was completed. The second bridge at Clairfontaine was completed during the night of 21-22 November, but was never able to carry more than 2½-ton trucks because of poor approach roads in the rapidly flooding valley. Noon the 22 November saw the last 3rd Division vehicles across the Meurthe. The initial phase of Powerhouse I was history.

The hard fighting in the weeks just prior to the Meurthe and the further destruction of the enemy on the east bank of the river broke the back of his resistance west of the Rhine in the corps sector. Six days of further relentless night and day attacks carried the VI Corps through the Vosges Mountains, across the Alsatian Plain, and into Strasbourg. For the second time in the 20th Century American Troops began a "Watch on the Rhine."

CHAPTER 8

Infantry Radio Communication

The importance of radio as a means of communication has been clearly demonstrated during the past war as every commander will testify. The modern army with its high degree of mobility has come to depend more and more on this mobile and versatile means of communication. It is necessary then that all officers examine and reevaluate their knowledge of this all-important subject, in the light of its present day importance.

In order to properly appraise the value of this means of communication, it is necessary to consider the capabilities and limitations of Infantry radio equipment. The most obvious advantages are that they possess a *high degree of mobility* and *flexibility of operation.*

The high mobility of radio results from the fact that no physical means of connection is required between the several stations of a radio net. Thus, continuous communication can be maintained within range limits of the sets, at all times. The flexibility of radio communication can best be explained by the fact that within its range and frequency coverage, a station may report into a net other than its assigned net to give or obtain vital information in case of emergency.

The limitations of radio as a means of communication are generally well recognized. Some of the more important are that radio is:

a. Subjct to disruption by atmospheric conditions.

b. Affected by the nature of the terrain.

c. Subject to jamming by the enemy and interference from friendly stations.

d. Subject to monitoring by the enemy which may result in breakdown of codes and ciphers when a volume of cryptographed messages are transmitted or may reveal troop dispositions and movements by an analysis of traffic.

It should be realized, however, that each of these limitations can be reduced by improved technique. This applies to both officer and enlisted personnel. The staff officer and the radio operator are equally responsible; one for the tactical use of radio, the other for the habitual use of proper procedure.

CHARACTERISTICS OF INFANTRY RADIOS

Radios designed for use by the Infantry must possess certain characteristics which afford them the highest possible degree of mobility and flexibility within the limits imposed by mechanical factors. Regardless of other qualifications, an Infantry radio set must have:

a. A high degree of portability.

b. An integral power supply capable of attaining the required range.

c. A maximum number of clear channels.

Because the Infantry normally moves on foot, it is imperative that all of its radio equipment be light enough to be carried by one man or be designed so that it can be broken down into one man loads. Each of the loads must be less than 40 lbs in weight and should be sufficiently compact so that it can be strapped on the back or mounted on a pack board. A 40 lb load can be carried any place that troops can go at approximately the same rate of speed; to exceed this weight is to sacrifice mobility of the set.

An integral power supply capable of attaining the required range is equally as important as maintaining mobility. Frequently it is necessary to compromise between these two factors in order to attain the best possible results. As all of the present Infantry type radios except the tank-mounted AN/VRC-3 can be operated from dry cell batteries, it is obvious that the weight of the batteries constitutes a definite portion of the total weight of the set. In general, the weight of the batteries must be increased in direct proportion to the maximum range of the set. The problem of

the designer of the radio sets is to keep the total weight of the set down to the minimum and at the same time provide a portable power supply capable of attaining the desired maximum range.

Recent improvements in dry cell batteries have reduced the weight-power ratio; other improvements are expected to further reduce this factor but it is obvious that the range of Infantry radio sets will continue to be governed by the limitations on weight of the power supply unit.

Another factor to be considered is that the range of Infantry radios should be limited because they are normally in close proximity to the enemy and hence subject to monitoring or interception.

The third requirement of a set is that it must be designed to give a maximum number of clear channels within its frequency range. This is desirable for two reasons. First, a greater number of sets can then be operated over a given frequency range. Second, greater latitude for inter-net communication is possible.

The present Infantry radio sets were designed to meet a definite, predetermined, tactical need. The agency charged with design was directed to produce test sets with prescribed standards of performance within maximum allowable weight and size. They are obviously the result of compromises between these various factors and are designed to give the maximum practicable range with the minimum practicable weight.

FREQUENCY RANGES

Radio frequencies extend from 20 kilocycles (20,000 cycles) to over 30,000 megacycles (30,000,000,000 cycles). The frequencies are divided into groups, or bands, for convenience of study and reference. (See figure 59.)

Low-Frequency (l f)	30 to 300 kilocycles
Medium-Frequency (m f)	300 to 3,000 kilocycles
High-Frequency (h f)	3,000 to 30,000 kilocycles
Very-High-Frequency (v h f)	30,000 to 300,000 kilocycles
Ultra-High-Frequency (u h f)	300,000 to 3,000,000 kilocycles

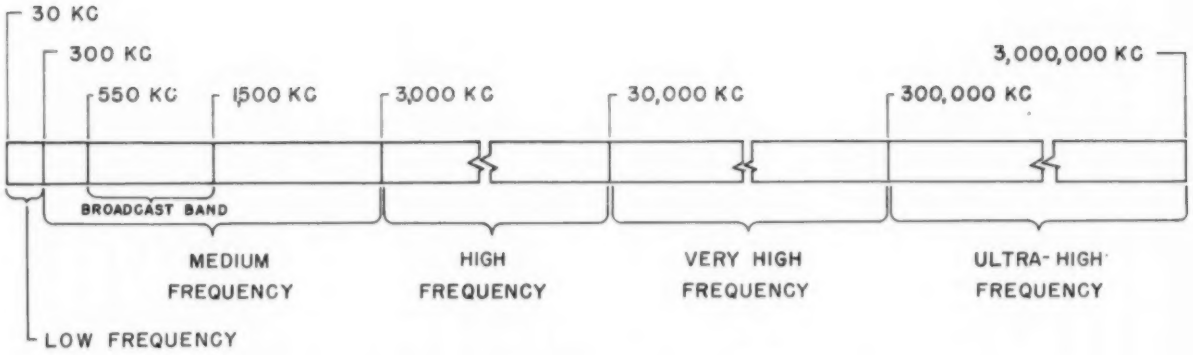


FIGURE 59.—Radio spectum (not to scale).

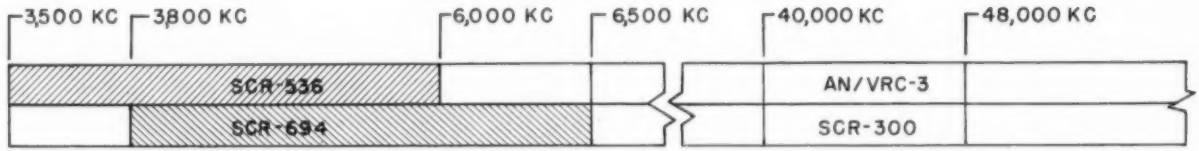


FIGURE 60.—Frequency coverage of Infantry radio sets.

NOTE: 1,000 cycles equals 1 kilocycle. 1,000 kilocycles equals 1 megacycle.

The Infantry radio sets, SCR-536 and SCR-694, are in the high frequency band while the SCR-300 and AN/VRC-3 are in the very high frequency band. Taking a portion of the spectrum shown in fig. 59 and placing the Infantry sets in their relative position as to frequency we see that frequencies of the SCR-536 and SCR-694 overlap. Consequently these sets can communicate with each other provided certain conditions are met which will be enumerated later. (See figure 60.)

SCR-536

The SCR-536 is a low-power voice radio set. It is designed for two-way communication up to ranges of one mile. Total weight of the set, including batteries and all equipment necessary for transmission and reception contained in one aluminum case, is five and one-half pounds. The set is crystal controlled for both reception and transmission and operates over frequency range of 3,500 to 6,000 kilocycles. Each unit is adjusted to work on only one frequency. (A radio technician can alter the frequency of the set by changing crystals and certain other parts.)

The distribution of the SCR-536 within the Infantry regiment is seven per rifle company and six per heavy weapons company. The principal employment is for maintaining communications from platoon headquarters to company headquarters; however, they are also suitable for maintaining contact with observation posts, outposts and patrols if distances involved are not too great.

This set is simple to operate and takes no special training other than learning the correct voice-radio procedure. It is automatically turned on when the lower section of the antenna is extended. It should be operated with the antenna fully extended and in an upright position. (Operation of the set is seriously hampered when the antenna comes in contact with foliage of trees.) Life of the batteries is normally fifteen hours. When either battery runs down,

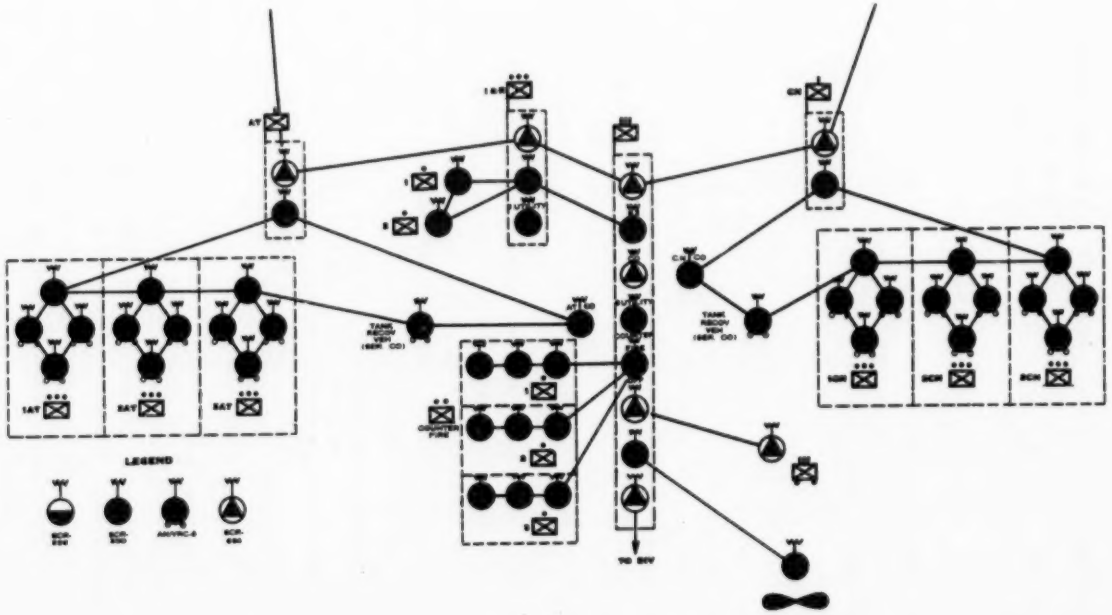


FIGURE 61.—Radio nets of the Infantry regiment.

both should be replaced. The set should be kept as dry as possible at all times as excessive moisture will render it inoperative. While rugged in construction, the SCR-536 should be handled with care as it is not shockproof.

SCR-300

The SCR-300 is a low-power, portable radio set designed for two-way voice communication over short ranges. The set comes equipped with two types of antennas which are commonly referred to as the long and short antennas. The rated range of the set with the long antenna is three miles or over, depending on operating conditions. The range of the set with the short antenna is slightly less. The short antenna should always be used while operating on the move as the set may be seriously damaged if the long antenna catches on low branches or other obstructions. When operating from a fixed position, however, the long antenna will produce the best results. The short antenna has a flexible section which enables it to be adjusted to an upright position.

The SCR-300 has 41 channels operating over a frequency of 40 to 48 megacycles (40,000 to 48,000 kilocycles). Each set is hand calibrated at the time of manufacture, thus assuring a high degree of accuracy of tuning by channel setting.

The distribution of the SCR-300 is as follows:

One	per rifle company.
Five	per heavy weapons company.
Five	per antitank company.
Five	per cannon company.
Three	per battalion headquarters company.
Twenty-three	per regimental headquarters company.

In the rifle company, the SCR-300 operates in the battalion command net. The five SCR-300s of the heavy weapons company may be used in several different ways, depending on the communication requirements of the company and battalion.

The following is an accepted disposition:

a. One with the company commander who is usually near or with the battalion commander.

b. One at the mortar position of the 81-mm mortar platoon.

c. One with each of two forward observers for the 81-mm mortars.

d. One with the gun platoon.

In this case the five heavy weapons company SCR-300s would be on the same channel and would comprise the heavy weapons company net.

The three SCR-300s of the battalion headquarters company may be distributed as follows:

a. One set at the battalion command post.

b. One set with the battalion commander.

c. One set to be used as a utility set and sent where needed.

The battalion command net will then consist of the three rifle companies' radios, the battalion command post radio, and the battalion commander's radio. All sets will necessarily operate on the same channel setting.

As the SCR-300s in both the antitank and cannon company are employed in a like manner, only their normal distribution in the antitank company will be discussed. The five SCR-300s may be used to advantage in the following manner:

a. One set with the company commander.

b. One at the company command post.

c. One with each of the three platoon leaders.

The command nets of both antitank and cannon companies will then be composed of the company commander, company command post and the three platoon leaders. (Each of the nine tanks and the tank recovery vehicles are equipped with AN/VRC-3's.)

The 23 SCR-300s of the regimental headquarters company may be employed as follows:

a. One with the counterfire officer and three with each of the three counterfire squads. This accounts for ten sets and would comprise the counterfire net.

b. The regimental S-2 net requires five sets; one with the S-2, one with each of the three squads of the I & R platoon and one utility set.

c. The air-ground net is made up of the ground set at the regimental command post and the set mounted in the liaison plane.

d. The above allocation leaves a total of six utility SCR-300s to be employed as required or used as replacement sets.

The SCR-300 has proved to be of outstanding merit. It is the first of the Infantry sets to use FM (frequency modulation). Although the subject of frequency modulation is beyond the scope of this article, it is worth noting that FM is finding even greater application in newer military radio sets.

AN/VRC-3

The AN/VRC-3 is the vehicular counterpart of the SCR-300 and for all practical purposes their characteristics are identical. The AN/VRC-3 is allotted as follows:

Nine.....per antitank company.
Nine.....per cannon company.
Two .....per service company.

In the antitank and cannon companies the AN/VRC-3s are mounted in the M-26 and M-45 tanks for maintaining communication with foot troops and are netted with the SCR-300 radio belonging to the unit with which they are operating.

The AN/VRC-3s of the service company are mounted in the tank recovery vehicles. These vehicles are normally employed in support of both antitank and cannon company, and, if such is the case, the channel of the supported company is used on the AN/VRC-3.

SCR-694

The radio set SCR-694 is a two-way radiotelephone and telegraph unit. It provides efficient communication between moving or stationary vehicles, or can be used as a portable

ground-mounted set. The weight of the set for ground operation is approximately ninety pounds and for vehicular operation, one hundred fifty pounds.

The operating range of the SCR-694 is fifteen miles for voice and thirty miles using (CW) code operation, between moving vehicles. The frequency range of the set is 3,800 kilocycles to 6,500 kilocycles. The SCR-536 and SCR-694

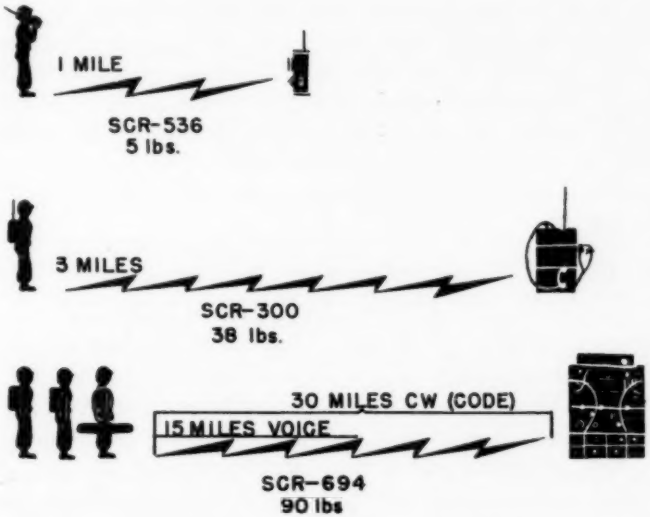


FIGURE 62.—Chart showing range and weight of Infantry radios.

can communicate with each other simply by tuning the SCR-694 to the pre-set frequency of the SCR-536. The range of the frequency overlap is illustrated in fig. 60. The distribution of the SCR-694 within the Infantry regiment is as follows:

One per battalion headquarters company.
One per antitank company.
One per cannon company.
Six per regimental headquarters company.

In each battalion the SCR-694 is employed in the regimental command net and is normally located at the battalion command post. The antitank and cannon company sets are also used for maintaining communication with regimental headquarters. One of the SCR-694s assigned to the regimental headquarters company is also used in the regimental command net; another is assigned to the I & R platoon. The regimental command net consists of the three battalions, antitank company, cannon company, I & R platoon, and the net control set at regimental headquarters.

One of the regimental SCR-694s is reserved for use of the commanding officer when he leaves the command post. In that event, this set also becomes a station in the regimental command net. Of the two remaining sets, one is set up at the command post and the other at the regimental train bivouac. (This latter set is sometimes referred to as the S-4 set.)

A comparison between the three sets, SCR-536, 300 and 694 on the basis of portability, range and weight, is illustrated in fig. 62. It is apparent that these radios meet present requirements for Infantry sets. With the proper care and maintenance and placed in the hands of capable operators, they will give excellent service. They are a means of communication with which every doughboy has become familiar and upon which every commander has learned to depend.

The number and types of radio sets to be found in the Infantry regiment in the future, and probably the *very near future*, is open to question. In the last few years much has been learned about military radio equipment both in the field and in the laboratory. The end of the war did not see the end of research and testing on this subject. New sets are continually being designed and tested which embody the latest developments in electronic advancement. Whatever the tactical need, the technical experts, with years of experience behind them, are making plans to produce a set which will fulfill the requirements. Frequency modulation (FM) will become more and more standard in Infantry radio sets;

the design of new batteries will decrease their weight and increase their life; the over-all weight of the sets will be decreased by improved design of the set and power supply unit; the range of the sets and the number of channels avaliable will be increased; they will become even more simplified in operation and more easily maintained.

CHAPTER 9

Gun Platoon in the Attack

The following article is adapted from a conference and problem currently being used for instruction at The Infantry School. The problem can be easily adapted to any available terrain, requires only a minimum time for prior preparation and planning, and provides excellent training for the platoon leader and squad leaders in selecting and occupying positions.

Addition of a gun platoon armed with six 75-mm recoilless rifles to the heavy weapons companies has greatly improved their ability to support the rifle companies in the attack or reinforce them in the defense. Because of the mobility and firepower of this versatile Infantry weapon, the assault troops can depend upon receiving prompt and adequate close supporting fires and thus are capable of maneuvering more rapidly and aggressively in the attack or holdmore vigorously in the defense.

The gun platoon, consisting of one officer and 32 enlisted men, is divided into a command group and three identical squads. The command group consists of a 1st Lieutenant Platon Leader who is responsible for the training, discipline and tactical employment of the platoon; a technical sergeant, second-in-command, who is normally responsible for ammunition supply of the platoon and the dispersion, camouflage and movement of platoon vehicles; and a private who is the driver and platoon messenger. (Note: Because of the weight of the weapon and ammunition, the squads carry only one gun forward in the attack. When this occasion arises, the platoon sergeant also supervises the transportation of the remaining guns on the weapon carriers.)

One of the three identical squads is shown in figure 63. In each squad there is a squad leader (staff sergeant) who is responsible for the employment of the squad. He is armed with an M1 rifle and equipped with binoculars, compass, gunner's quadrant, firing table, and direct and

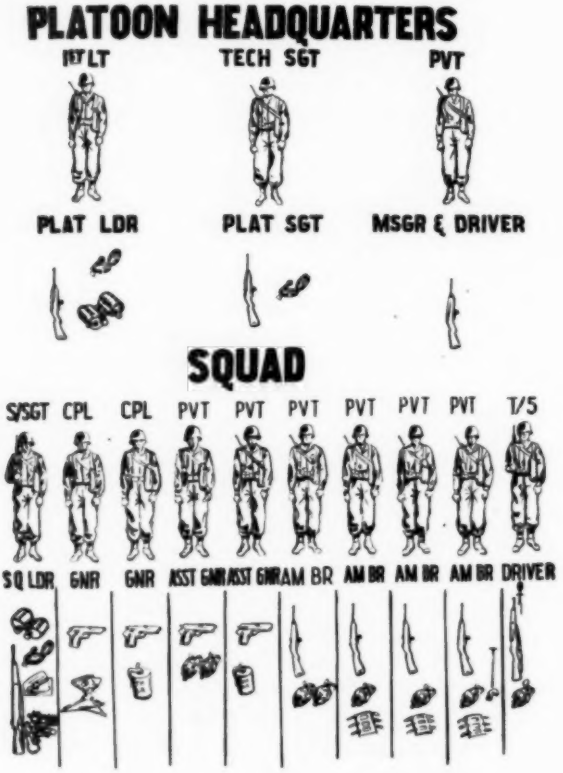


FIGURE 63.—Organization of the 75-mm gun platoon.

indirect fire sights. The No. 1 man in the squad is the corporal gunner who lays and fires the piece. He is armed with a .45 caliber pistol and during movements by hand he carries the tripod and cradle. The No. 2 man is also a corporal gunner. When both the squad weapons are employed

simultaneously he lays and fires the second piece. In a fast moving attack, when only one gun of the squad is employed, he becomes an assistant gunner and aids in carrying the gun. The No. 2 man is armed with a .45 caliber pistol and carries a thermite grenade which he uses to render the piece inoperative if it should become necessary to abandon the gun. The No. 3 man is an assistant gunner, and is armed with a .45 caliber pistol and carries two fragmentation grenades. The No. 4 man, an assistant gunner, is armed with a .45 caliber pistol and carries a thermite grenade. The No. 5 man is an ammunition bearer and is armed with a carbine and carries two fragmentation grenades. Numbers 2, 3, 4, and 5 carry the weapon. Numbers 6, 7 and 8 are ammunition bearers carrying a pack board with two rounds of ammunition. They are armed with carbines and each carries a fragmentation grenade. The No. 8 man carries in addition, a rammer staff and waste for cleaning the piece. The No. 9 man is the driver of the squad vehicle. He is armed with an M1 rifle equipped with a M7 grenade launcher, and carries one fragmentation grenade.

The primary weapons of the gun platoon are six 75-mm recoilless rifles. (See Figure 64) Each squad has two of these rifles, complete with direct and indirect firing sights. In a fast moving attack the squad can carry only one rifle; the other rifle is left on the squad weapon carrier. There are three rocket launchers in the platoon, twelve .45 caliber pistols, six caliber .30 M1 rifles and fifteen caliber .30 carbines. One rocket launcher is assigned to each squad. For transportation, the platoon headquarters has one ¼-ton truck, on which is mounted a .50 caliber machine gun. Each squad has a 1½-ton truck and a 1-ton trailer for transportation of the guns and ammunition. (See Figure 64)

Although one SCR 300 radio is assigned to the platoon, it is dependent on the heavy weapons company for allocation of additional communication equipment. (The company has five SCR 300 radios, six SCR 536 radios, and twenty CE-11 sound-powered telephone sets or ten channels of wire communication.) The lack of organic communication presents a problem of control, especially when the platoon is

FIGURE 64.—Armament of the gun platoon.

firing indirect fire. There are several possible solutions to this problem. In the event the guns are firing indirect fire, it may be possible to utilize the radios and observation posts of the mortar platoon for transimtting fire data to the gun position. The platoon's SCR 300 radio would be at the gun position on the same channel as that of the mortar platoon. Another possible solution is the use of company sound-powered telephones. Two phones would be sufficient to do the job; one phone at the observation post and the other back at the gun position. When using direct fire the problem of control is comparatively simple as the gunner is in position where he can see the target and adjust fire.

Fire control instruments such as a range finder and an aiming circle may be allotted to the platoon. These instruments must, of necessity, be shared with the other platoons of the company.

MISSIONS OF THE PLATOON IN THE ATTACK

The mission of the heavy weapons company is to give close and continuous support to the attacking rifle units. The mission of the gun platoon in the attack is to provide direct support to the attacking echelons. Because of its mobility, low silhouette, and high degree of accuracy, this weapon is well suited for its normal mission. (See figure 65.)

An example of the mobility of the 75-mm rifle was brought out during the test firing in the Pacific (*Final Report AGF Special Weapons Demonstration Team in Middle Pacific Areas*). This demonstration team under the direction of Major Robert Montgomery test fired this weapon under combat conditions on Okinawa. While attached to the 3rd Battalion, 383rd Infantry, the team was directed by the battalion commander to move from the battalion observation post across an open valley to the first escarpement of Yuza-Dake, then occupied by forward elements of his battalion, to engage cave positions holding up the advance. One 75-mm rifle, with thirty rounds of ammunition, and a crew of five men was loaded in two ¼-ton trucks and moved quickly across the valley to the escarpement. Sporadic ineffective machine gun fire was delivered on the vehicles as

MISSION

I DIRECT SUPPORT OF ATTACKING ECHELON

A. DIRECT FIRE
1 TANKS AND VEHICLES
2 AUTOMATIC W P NS EMPLACEM'T
3 CASEMENT EMBRASURES
4 ANTITANK GUN EMPLACEMENTS
5 GROUPS OF PERSONNEL

B. INDIRECT FIRE - USED ON PROFITABLE TARGETS WHEN IMPRACTICABLE TO ENGAGE DIRECT FIRE TARGETS.

II ASSIGNMENT TO COMBAT

A. WHEN TERRAIN PERMITS ENTIRE BN COVERAGE - USED AS PLATOON

B. WHEN TERRAIN NOT FAVORABLE - USED BY ATTACHMENTS TO RIFLE COMPANIES

C. GROUPED TO SUPPORT A MAIN EFFORT

FIGURE 65.—Normal missions of the gun platoon.

they moved across the valley. No particular difficulty was encountered in carrying the weapon and ammunition up a 45-degree slope and finally up an almost vertical escarpement to put it into firing position.

In the analysis of targets taken under fire during this operation, the number of rounds fired varied from four to eight. Direct hits were usually secured on the first or second round—the additional rounds were fired to insure complete neutralization.

By using direct fire, the gun platoon can be used for support against targets much closer to friendly troops than either mortars or artillery. Appropriate targets for the gun platoon are:

1. Tanks and vehicles of all types.
2. Automatic weapon emplacements.
3. Casement embrasures.
4. Field and antitank gun emplacements.
5. Groups of enemy personnel.

Another method of supporting the attacking elements is by indirect fire. In the event the enemy situation has not developed to the point where specific targets have been located, the gun platoon may be emplaced in a battery firing position and deliver indirect fire, thus augmenting the other supporting fires of the battalion. It should be borne in mind however, that the number of targets which may be engaged using indirect fire are somewhat limited by the flat-trajectory of the shell. This obviously prevents placing fire on rear slopes. Although mask clearance limits the minimum range obtainable, the gun platoon of the reserve battalion is frequently able to employ its weapons from an indirect firing position in support of the attacking elements as it is far enough to the rear where mask clearance does not offer such a difficult problem.

In this discussion of missions the terms primary and secondary have not been mentioned. The 75-mm is an excellent antitank weapon. When the possibility of attack by hostile armor is remote the effectiveness of the fire of these weapons is too great to justify their being held out of action

for the purpose of engaging enemy mechanized vehicles if, and when they make their appearance. Even when engaged on a mission, it is obvious that should hostile armored vehicles appear, they will be promptly engaged by the 75-mm rifles as well as all other suitable weapons.

Assume a situation where a squad is engaged in firing at an emplacement and enemy tanks make their appearance. The tanks present the greatest threat and must be stopped before they reach the troops. The emplacement is stationary and once the tanks have been knocked out the squad can resume fire on the emplacement.

In the event that the presence of hostile armor makes counterattack with tanks imminent, the battalion commander may hold his entire gun platoon out of action in a position of readiness to engage the attack when it develops.

ASSIGNMENT FOR COMBAT

Centralized control of the battalion comander.—When positions are available from which the platoon can support the effort of the entire battalion by direct fire, the gun platoon should be kept under the centralized control of the battalion commander. Employed in this manner the platoon can quickly concentrate its fires on appropriate targets within the battalion zone of action. Such favorable positions are difficult to find.

Attached to a rifle company.—Another method of employment is the attachment of one or more squads to an attacking rifle company. When observation and control are limited, the battalion commander may place gun squads under the command of a rifle company commander. By doing this he gives that rifle company commander extra fire power. In this case only a portion of the fire power of the gun platoon is available to any one company.

Mission-type order.—The platoon may be given a mission-type order. For example, in his plan of attack, the battalion commander may assign the gun platoon the mission of supporting the main effort.

SELECTION OF FIRING POSITIONS

The first point to consider is the mission. It must be accomplished regardless of anything else, and to do this, it may be necessary to compromise some of the factors which follow.

Type of target.—The platoon may be assigned a point target or a sector to be covered by fire. (Point targets may be weapons emplacements, casement embrasures, vehicles of all types, etc.) The type of target assigned materially affects the selection of firing positions. Direct fire is the best way to engage located targets. However, to get direct fire, it may be necessary to move the guns into an open or exposed position or into partial defilade. To cover an area target it may be possible to move into position defilade and use indirect fire.

Location of friendly troops.—In respect to friendly troops we can place the guns in one of three locations—on line, on the flanks, or in the rear (overhead fire). As the line of departure is usually subject to a volume of enemy fire, the on line position is the least desirable location for the guns. As soon as the weapon is fired, the tremendous backblast created leaves no doubt in the enemys mind as to just what weapon is firing and where it is located. This is especially true if the enemy has superior observation. Consequently, it is more advantageous to keep the weapons behind the line of departure, if possible, and take advantage of its long-range effect. (When the demonstration team mentioned earlier fired the weapon within 200 yards of the front line, the fires of all enemy weapons from sniper fire to 105-mm artillery fire were immediately brought to bear on the position. As a result, the demonstration team recommended that 75-mm rifles be employed 200-800 yards behind the front lines.)

The 75-mm rifle may also fire from the *flanks of supported units* or deliver overhead fire from *defiladed positions in rear of friendly troops.* Either of these alternatives are preferable to positions in the front lines.

The terrain.—The rifle may be fired from position defilade, or from open or exposed positions. The selection of positions will be directly linked to the kind of target to be engaged or to the mission assigned.

In any case the position selected must be such that the platoon can accomplish its mission. However, there are other factors to be considered when selecting firing positions:

1. When using direct fire, the gunner must be able to see and hit the target. Therefore, he must have good observation and fields of fire which are free from trees, brush and other obstacles.

2. Covered positions in the general vicinity of the gun are a very desirable characteristic of a good position. It is also desirable for all men to have covered positions nearby in the event the enemy lays down counterbattery fire.

3. Cover and concealment is another factor to be considered. When selecting positions for the gun platoon, the difficulty of concealment of the weapons once fire has been opened must be kept in mind. When engaged in indirect fire the mask must be of sufficient height to conceal the flash from enemy observation. When the weapons are firing direct fire, full advantage must be taken of all natural cover.

4. Selection of alternate and supplementary positions is necessary. *The weapons will not normally fire more than one mission from any one position.* Frequent and rapid displacement to alternate positions is vital to prevent the weapons from being subjected to enemy counterfire.

5. Routes of occupation and supply are another important factor governingthe selection of firing positions. A route to get in and out of position, and a route over which the ammunition can be supplied to the guns is essential. These routes should be short, covered, and concealed. The problem confronting a mortar platoon leader in regard to ammunition supply is well known. Try now to visualize the gun platoon leader's supply problem with a larger and

heavier round which weighs approximately 24 pounds and very often must be hand-carried for appreciable distances. Consequently, a very limited amount of ammunition (6 rounds per squad) can be carried by the gun crew. Therefore, the firing positions must be selected with due consideration to resupply ammunition.

6. Because of the vulnerability of the guns and crew to infantry attack, positions must be selected where protection can be obtained from rifle units in the vicinity. Nevertheless, every unit leader is responsible for the security of his own outfit.

7. The time element must also be considered. If the position is not occupied on time the mission cannot be accomplished.

PART II

MISSION OF THE GUN PLATOON IN THE ATTACK

1. *Situation—Sketch map.* (figure 66).—The 314th Infantry Regiment attacked to the SW at 0500 with the 1st and 3d Battalions abreast. The regiment made good progress initially but enemy resistance has increased. The 3d Battalion has been held up on the line LONG HILL-REYNOLDS HILL. The 2d Battalion has been ordered to relieve the 3d Battalion and continue the attack. The gun platoon is now in the company assembly area (see map). The platoon leader of the gun platoon and his messenger have come to HOLLIDAY HILL to receive the following attack order from the company commander:

COMPANY ATTACK ORDER

1a. The enemy, estimated as one reinforced rifle company, occupies GREEN AND DAVIDSON HILLS.

b. Our battalion will attack at 1015 hours, seize GREEN and DAVIDSON HILLS and continue the attack to the SW. Easy Co with its right flank on the stream bed in the draw will attack on the left and seize GREEN HILL. Fox Co with its left flank on the stream bed will attack on the right and seize

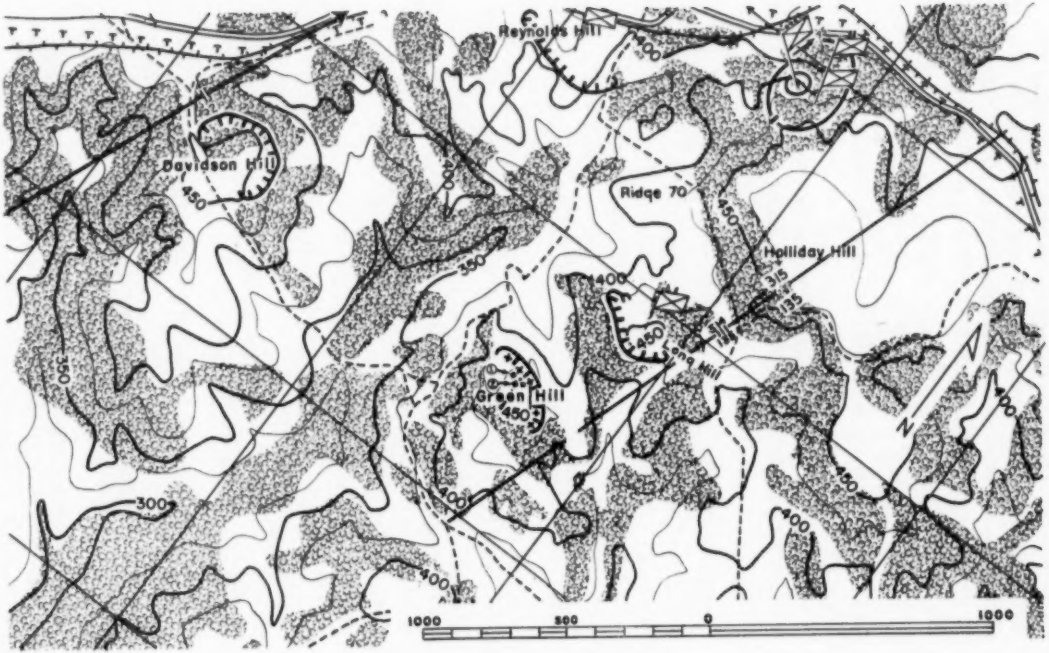


FIGURE 66.—Map of problem area.

DAVIDSON HILL. (Battalion boundaries — see sketch.) Line of departure—present front lines on LONG HILL and REYNOLDS HILL. The 1st Battalion is on our right, and the 135th Infantry on our left.

2. This company will suport the attack.

3a. 1st and 2d Platoons will support the attack from positions on HOLLIDAY HILL and REYNOLDS HILL.

b. 81-mm mortar platoon will support the attack from positions NE of HOLLIDAY HILL.

c. Gun Platoon: 1st Squad is attached to Fox Co, platoon less 1st Squad will be in direct support of Easy Co. Platoon will open fire at H-2 on pillboxes #1 and #2. (See figure 66.) Initial positions on RIDGE 70. Displace to LONG HILL when the troops cross the line of departure. Upon capture of the objective the platoon (less 1st Squad) will support the reorganization of Easy Co.

x. All units notify me when you are in position.

4. Bn aid station NE of HOLLIDAY HILL;
Co ammunition supply point in present company assembly area.
Weapon carriers released to you now.

5a. Emergency signal to lift fire - red star cluster.

5b. Battalion command post in rear of HOLLIDAY HILL.
Company observation point for the attack - HOLLIDAY HILL.

ARE THERE ANY QUESTIONS?
"Time is now....."

2. *First requirement.*—What are the actions taken and orders issued by the platoon leader after the receipt of the company attack order to the time he actually makes his reconnaissance?

3. *A solution of the first requirement.*—The platoon leader plans his reconnaisance of RIDGE 70 and LONG HILL. He then selects RIDGE 70 for a vantage point as it is of sufficient height for him to point out the various points on the terrain when he orients the squad leaders.

The platoon leader then sends a message to subordinate leaders and the troops. The message should include arrangements for meeting the squad leaders at the vantage point, attaching the 1st squad to Fox Company, and alerting the platoon for movement into firing positions. He then makes his reconnaissance.

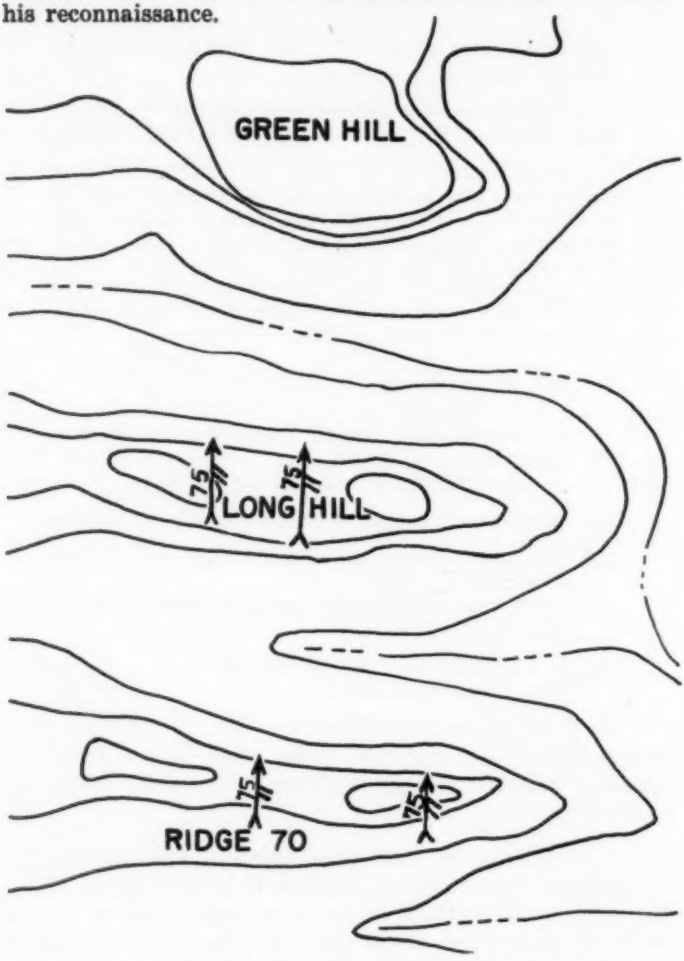


FIGURE 67.—Sketch showing firing position of the platoon.

4. *Second requirement.*—Plot the gun positions for two guns on RIDGE 70 and two guns on LONG HILL.

5. *A solution to the second requirement.*—Figure 67 is a blown up sketch of RIDGE 70 and LONG HILL. The gun positions and the directions of fire are indicated by symbol.

6. *Situation continued.* The platoon leader having decided upon the location of the gun positions, issues the order to the assembled squad leaders. In the order he includes the enemy and friendly situation, the mission of the company, and the mission of his platoon. He further directs that the right squad will engage pillbox #2 and the left squad will engage pillbox #1. The squad leaders, after the order has been issued, move out to put it into effect. The platoon moves into position and at H-2 engages the designated targets. The foot troops cross the line of departure.

7. *Third Requirement.* What is the method of displacement in moving the platoon from RIDGE 70 to LONG HILL?

8. *A solution of the Third Requirement.* The platoon leader displaces by squad echelon. In this manner he moves the platoon forward and at all times maintains close and continuous support which is his mission in the attack. Should any targets appear while a squad is displacing, the squad which remains in position can rapidly engage it. Such would not be the case if both squads were displacing at the same time.

9. *Situation Continued.* The squads have displaced to LONG HILL. While the second squad was displacing, a machine gun, which up to this time has remained silent, opens fire from a well concealed position. The squad which remained on RIDGE 70 (after shifting to an alternate position) engages and places effective fire on the enemy weapon. The second squad has reached LONG HILL and is going into position, the third squad leader observed this and now displaces his squad forward. Easy Company is assaulting GREEN HILL and it appears that capture is iminent and fires of the platoon have been masked.

10. *Fourth Requirement.* Actions and orders of the platoon leader.

11. *A solution to the fourth requirement.* He plans the displacement of the platoon to GREEN HILL as the company attack order gave him the mission of supporting the reorganization of Easy Company and his platoon cannot accomplish this mission from its position on LONG HILL. Bearing in mind the mission, the platoon leader displaces one squad, leaving the other in position. He then leads the displaced squad up to positions of readiness behind the crest of GREEN HILL. The platoon leader then moves forward on reconnaissance to determine the most likely avenues of approach and the best positions from which to cover them. When the squad which remained behind observes the other squad move up on GREEN HILL, it too displaces forward. By the time the rear squad reaches the hill, the platoon leader has completed his reconnaissance and assigns missions and position areas for both squads.

12. *Discussion.* The location of the weapon carriers affects the operation of the platoon in combat. Under the supervision of the platoon sergeant, they must be kept far enough forward so that ammunition supply will not be difficult. Their location should normally be behind the next terrain feature in rear of the gun positions. This will eliminate a long hand-carry and will facilitate ammunition supply.

13. *Summary.* It has been the purpose of the problem just outlined to illustrate the procedue a gun platoon leader follows to accomplish his mission. The steps in troop leading procedure from the time the platoon leader received the company attack order until the platoon occupies the position are covered. The problem illustrated two methods of assignment for combat of the gun platoon. Further actions and orders of the platoon leader are contingent upon subsequent orders from the company commander.

CHAPTER 10

Athletics in the Physical Training Program

The purpose of this article is to discuss current polices and directives of the Army Ground Forces in regard to the organization and conduct of the physical training and athletic program.

Like any other phase of military training the conduct of the physical training program changes from time to time. As these changes are generally made to conform to the exigencies of the tactical situation, it is not surprising to find that the emphasis on the conduct of physical conditioning activities is today considerably different from what it was during or prior to the war. The emphasis desired today is on the conduct of competitive athletic and sports activities. As we all know, competitive athletic programs are not new to the army. What then is the difference between the present day programs and those which have been used in the past? In order to differentiate between them, it is advisable to briefly compare those in use before the war, during the war, and since the cessation of hostilities.

THE PREWAR PROGRAM

The basis of the physical training program before the war was calisthenics (setting-up) exercises supplemented by mass games and athletic competition among regimental, battalion, and company teams. Periods devoted to physical training varied as to the length and the number scheduled each week. Rarely did the period exceed one hour. In some instances short periods of from fifteen to thirty minutes daily were used, which were devoted entirely to calisthenics. At other times longer periods were scheduled two or three

times a week. These one hour periods were generally split so that a portion of each was devoted to calisthenics and the remainder taken up in the conduct of informal mass games or relays. Field Manual 21-20, Physical Training, dated 6 March 1941, provided sufficient variety of setting-up exercises, rifle exercises, games, relays, etc., so that if these activities were employed properly, they prevented the physical training period from becoming monotonous. The games played during these periods were such that little or no facilities were necessary to conduct them nor was a high degree of skill or knowledge of the game required of the participants. No record of winning teams (platoon or squad) was kept and very little incentive to be the winner was provided. It wasn't so important to be the winning team as it was to keep from being the loser, because the personnel of the losing team were nearly always penalized in one way or another. Games of this type are easily organized and conducted but have very little "carry-over" value. Soldiers practically never engage in this type of game voluntarily.

Because the inclusion of competitive sports and athletics in the physical training program had been advocated for some time, the peace-time army did provide rather extensive competitive programs in most of the major sports. However, little or no consideration was given to these activities during training hours. Certain privileges were sometimes granted to those who participated on higher echelon teams. For example, these men were excused from other physical training periods or were allowed to attend team practice sessions during late afternoon hours. The organization of athletic teams on a regimental or post level was generally excellent. Competition between company teams was well organized. Members of company teams were sometimes selected as a result of competition between platoon teams, but generally speaking, little opportunity was provided for most of the personnel to participate in this competition. Only those men with exceptional athletic ability were selected for the regimental or company teams.

In addition to the activities mentioned certain others were introduced into the program from time to time. Prior to qualification on bayonet and obstacle courses, training for them was scheduled during training time. Before field maneuvers the number of physical training periods was increased and tactical and non-tactical marches were secheduled for the purpose of toughening troops.

THE PROGRAM DURING THE WAR

If the problem of maintaining a high degree of physical fitness among the regular army troops was important during peace time, the importance of this problem was greatly magnified when this country was suddenly thrown into war and the army expanded almost overnight from several thousand to several million men. Not only were the men coming into the army found to be physically inferior to any previous group in our history, but also the necessity of preparing every one of these men for combat in a relatively short time was of crucial importance. Some of the demands that modern warfare require from troops preparing for combat were well expressed in War Department Pamphlet 21-9:

> "To march long distances with full pack through desert and jungle and over mountains, to drive fast moving tanks and motor vehicles over rough terrain, to make assaults and to engage in bayonet and hand-to hand fighting, to jump into and out of foxholes and trenches and over obstacles, to carry heavy objects, to keep going for many hours without sleep or rest—all these activities of modern warfare and many others require superbly conditioned troops. Even though this is a mechanized war, physical fitness is no less essential. Our machines are no better than the men who are operating them. The qualities of strength, speed, power and endurance are just as important in our fighting men as in our implements of war. Every new advance in the speed, maneuverability, striking power, durability and destructiveness of our machines must be accompanied by a corresponding improvement in the quality and fitness of our manpower."

Because it was felt that no one type of physical training activity could adequately provide the strength, agility, coordination, and endurance necessary to combat troops, the army conducted a series of comprehensive physical efficiency tests among 5000 troops in eleven different army camps during the summer of 1942. These tests revealed and emphasized the physical fitness needs of troops. Two groups of men were set up which were as nearly equal in age, weight, height, and physical condition as possible. One group was subjected to traditional physical training activities. The other group was given a recommended experimental program. The entire study was carefully controlled. After engaging in their respective activities for a certain period of time, both groups were again tested. The experimental group showed much more improvement and as a result a new program in the form of War Department Training Circular No. 87, 17 November 1942, replaced the traditional one specified in FM 21-20 (6 March 1941). Further controlled experiments to determine the relative percentage of physical improvement resulting from the use of the two programs showed that Training Circular No. 87 was seven times more effective than the traditional physical training program.

Training Circular No. 87 provided a variety of activities such as: calisthenics or conditioning exercises (as they are now called), guerrilla exercises, grass drills, combatives, running exercises, and speed marches. The exercises were simple, readily learned, required no equipment, and were easily and accurately controlled. For these reasons this program was adaptable to all units undergoing training and provided for a definite progression of development so that within a period of about two months troops could be brought to a peak of physical condition. Having reached this high level of condition, it then provided modifications whereby troops could be sustained in top condition. Physical achievement or physical efficiency testing was an integral part of this program. By giving periodical tests commanders could determine the degree of conditioning which their troops possessed.

It was in the "sustaining phases" that athletics and games of a competitive and vigorous nature were advocated. In most units, however, neither sufficient facilities were available, nor ample time allocated in which to conduct comprehensive and well organized competitive athletic activities. In units where these activities were conducted they were generally held during off-duty times when training periods were over—in the evenings, on Saturday afternoons, or on Sundays. Practically no consideration was given to their conduct during training time. Especially was this true for the majority of men undergoing training. Those teams that were organized and competed against each other were made up of the very best performers in a particular sport. This competition did provide a great deal of spectator interest and was of value for that reason. In general, however, it can be said that the conduct of athletics in the physical training program played only a very minor part as far as the conditioning and development of the majority of troops were concerned.

Although Training Circular 87 formed the basis for the conditioning of troops during the war, a number of other means were used to insure the fighting fitness of the army. Natural obstacle courses resembling a battlefield complete with barbed wire were used. Battle-conditioning courses which included small arms fire overhead and past the flanks of troops, overhead artillery fire, and close in artificial artillery fire in the form of buried explosives were used to condition the men mentally as well as physically for the shock of battle. Wherever facilities were available, swimming was taught to all men to prepare them for assault landing operations. In a number of basic training centers throughout the country "Waterbury Courses", which included a strength course, a confidence course, and a system of log exercises, were incorporated into the physical training program.

All of these activities were designed with but one objective; to require every man to be in the very best of

physical and mental condition in order to perform his battlefield functions and withstand the arduous, rugged, and vigorous existence of a soldier in combat.

THE POSTWAR PROGRAM

Since the cessation of hostilities a new physical training field manual, FM 21-20, dated January 1946, has been released which includes not only the provisions of Training Circular 87 with some modifications, but also such activities as rifle exercises, postural exercises, wrestling, hand-to-hand fighting, boxing, tumbling, swimming, lifesaving, and athletics.

The physical training program recently received a new emphasis with the issuance of War Department Training Circular No. 7, dated 10 July 1946. This circular provides for an Army-wide program to be conducted as a part of regular military training, and specifies that a minimum of five hours per week will be devoted to the conduct of two concurrent phases of the physical training program—a conditioning phase and an athletic phase.

The Army Ground Forces plans for participating in the Army-wide program were announced in Training Memorandum No. 1, dated 1 July 1946. This training directive includes six hours of training each week in the conditioning and athletic phases of the War Department program and also emphasizes the importance of the organization and promotion of a voluntary or recreational sports program. Because this training memorandum is applicable to all army ground force units and because physical fitness is a command responsibility in connection with training, it is imperative that we understand the purpose and nature of the program, how it can be organized, and what can be done to insure its success.

The purpose of this program is as follows:

1. To develop and maintain a high degree of physical fitness.

2. To develop team play and team spirit, aggressiveness, and the will to win, through competitive sports.

3. To develop and maintain a high degree of morale and discipline.

The program consists of two phases: the training or "on-duty" phase, and the non-training or "off-duty" (recreational) phase. The two phases are of equal importance. That they are of equal importance is shown by the fact that the G-3 and S-3 Sections of the various echelons of command are responsible for the over-all planning of both phases. An athletic branch has been established in the G-3 and S-3 sections to insure the proper operation of this program.

Because of the relation between the training and non-training phases, it is desirable that the training periods be devoted to instruction in those types of games or activities in which men normally participate during recreation periods. It is felt that the increased playing proficiency obtained by instruction in the more popular games during the training periods will have considerable "carry-over" value and will increase an individual's desire to participate in such activities on his own time. This theory, of course, presupposes the idea that during the recreational period facilities will be made available to him and that arrangements will have been made so that he can compete either on a team or as an individual. It is for this reason that the two phases are considered to be of equal importance and that definite personnel in the G-3 and S-3 sections are designated to be responsible for both phases.

How much time is to be devoted to these phases? It is specified that except during field training periods six hours per week will be scheduled for the training phase. Unlike the method previously used of having short physical training periods, these six hours are to be divided into two 1-hour periods and two 2-hour periods. The time devoted to the recreational period is of course practically unlimited.

What activities and what type of organization makes up these two phases? The answer to this question is best illustrated by the following outline:

1. Training, or "on-duty" phase:
   a. Required activities
      (1) Swimming
      (2) Boxing
   b. Sports Classes
      Instruction in individual skills and team play in football, touch football, speed ball, soccer, baseball, softball, basketball, and volleyball.
   c. Intra-unit competition in the above games.

2. Non-training, or "off-duty" (recreational) phase:
   a. Intra-unit competition (continuation of c above).
   b. Inter-unit competition—to include company, battalion, and regimental or post teams.
   c. Practice sessions and game schedules for unit teams.
   d. Individual sports, such as golf, tennis, table tennis, horseshoes, wrestling, archery, badminton, bowling, etc.
   e. Exhibition programs—to include military and civilian sport exhibitions and demonstrations, which will aid to stimulate overall interest in the athletic program.

Wherever facilities exist each man is to participate in swimming for a minimum of two 1-hour periods per week until he is able to pass the Advanced (A) Test as specified in FM 21-20. Wherever facilities for swimming do not exist this time is to be used for additional instruction and participation in athletics. Those men who are expert swimmers and who are not needed as swimming instructors or assistant instructors may take instruction in other sports during the swim period.

Thirty-five minutes of each of the two 2-hour periods are to be used for boxing instruction that will include warm-up exercises. These warm-up exercises may consist of conditioning exercises, grass drills, guerrilla exercises, etc. (FM 21-20). The remainder of the 2-hour periods is to be used for the conduct of sport classes and actual participation in physical contact type of competitive games.

ORGANIZATION OF THE PROGRAM

The general organization of the program is based on four units corresponding to the seasons of the year, just as school, college, and professional sports programs are organized. A suggested grouping of sports activities according to the seasons dates is as follows:

SPRING: March 16-June 15

Volleyball	Track and Field
Softball	Archery
Baseball	Golf
Tennis	Pushball
Table Tennis	Horseshoes

SUMMER: June 16-September 15

Softball	Golf
Baseball	Horseshoes
Track and Field	Tennis
Swimming (meets, etc.)	Archery

FALL: September 16-December 15

Football	Volleyball
Touch football	Cross Country
Soccer	Golf
Boxing	Cageball

WINTER: December 16-March 15

Basketball	Table Tennis
Bowling	Handball
Boxing (tournaments)	Speedball

Climatic conditions, facilities, personnel, and other factors may require certain adjustments from this suggested grouping. It will be noted that in many instances sports schedules run from one season into another. A number of other games can profitably be added to the above list.

When the athletic officer has selected the activities to be conducted during a particular part of the year or season, his job has just begun. If the purposes of the program as outlined previously are to be realized, the athletic officer's main objective is to assure *maximum*

participation by providing opportunities for all personnel to develop skills and participate in a variety of activities, both team and individual, at the level of each man's ability, capacity and interest. The opportunities to learn and develop skills will come through the proper conduct of sports classes. The opportunities to participate will be provided only through proper organization and scheduling of inter and intra-unit competition—both team and individual.

It is a logical assumption that men will take a greater interest in competition if they are given a chance to compete against others of about equal ability. A golfer who has to struggle to break 100 does not enjoy playing against a person who consistently plays in the low seventies any more than the latter enjoys playing with the high score shooter. However, they both enjoy playing with men whose scores are on a par with their own. In a team sport such as softball it makes little difference to the men who play the game if the score is 3 to 1 or 18 to 12 as long as the players are of about equal ability and each team has an equal opportunity to win. Competition must be organized for the various levels of playing proficiency: good vs good, medium vs medium, and poor vs poor.

The organization of inter-unit competition is an essential part of the athletic program to provide those men with exceptional athletic ability an opportunity to compete against each other. However, if we analyze the number of men normally involved in inter-unit competition we can readily see that this is not the most important part of the physical training program. Chart No. 1 illustrates the organization of inter-unit competition in respect to the various echelons of competition. Sports teams such as regimental or post teams are made up of men from those units who are the best performers in a particular sport. The competition among these teams is generally on a par. The men who make up the company teams also possess a lot of athletic ability but are not capable of performing as well as those men on the higher echelon teams. In a unit

the size of a regiment, how many men does this type of inter-unit competitive program affect? Take the sport of basketball as an example. The regimental team will comprise about 15 men. Each company team will be composed of about 10 men, which means that if ninteen companies enter teams another 190 men will participate in basketball competition during part of the playoff to determine the best team in the regiment. Therefore, a total of 205 men out of approximately 3000 will be participating in this inter-unit competitive activity. If we similarly analyze all of the other major sports, i.e., football, baseball, track and field, boxing, etc., we would find that considerably less than one-third of all men in a regiment would participate in this part of the athletic program. It is apparent, therefore, that the athletic officers must look for other methods of organization by which to gain "maximum participation" in athletic activities.

One means of increasing the number of participants in these activities is the continuation of intra-unit competition which is conducted during the training phase. Considering the company as the basic training unit, competition within the company can be conducted in several ways. In sports where the number of men making up a team is not too great, squad teams can be organized to compete against each other to determine the best squad within each platoon. These teams then play off to determine the best squad within the company. Or, the platoon can be disregarded and each squad compete with every other squad to determine which is the best. Because all sports do not readily lend themselves to the organization of squad teams, it is considered better to conduct all intra-unit team competition on a platoon basis. This does not mean that each platoon will have but one team. It does mean that based on the relative abilities of the team members, an "A" team, a "B" team, and a "C" team can be organized within each platoon. All of the teams within each class compete with each other to determine the best team in the class. "A" teams do not compete with "B" or "C" teams or vice versa. Chart No. 2 illustrates both the organization of squad teams and the

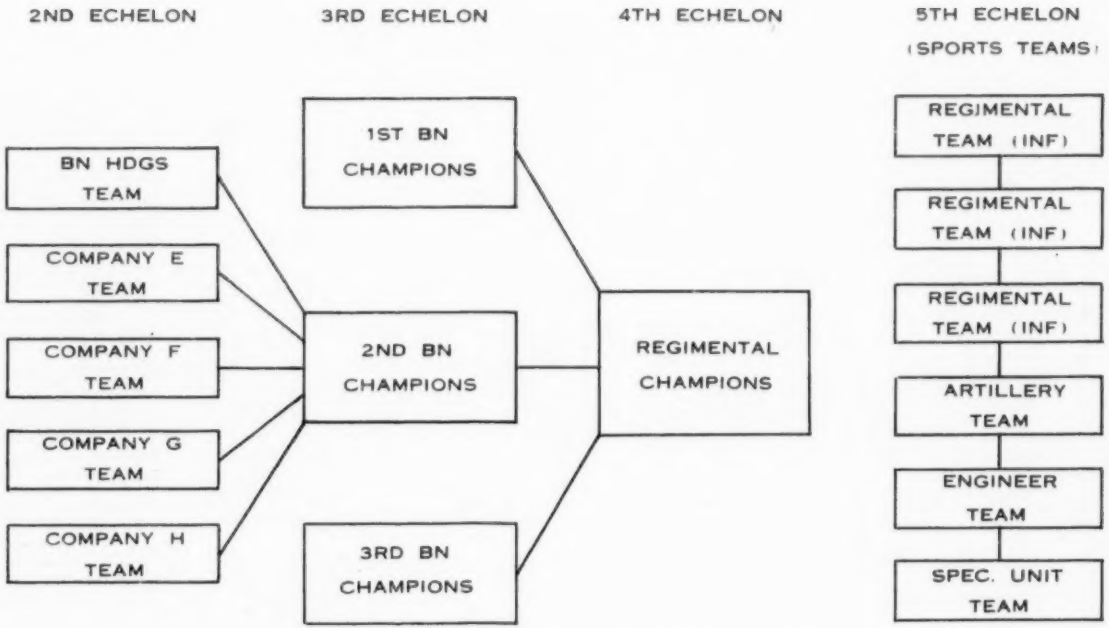


CHART NO. 1 INTER-UNIT COMPETITION

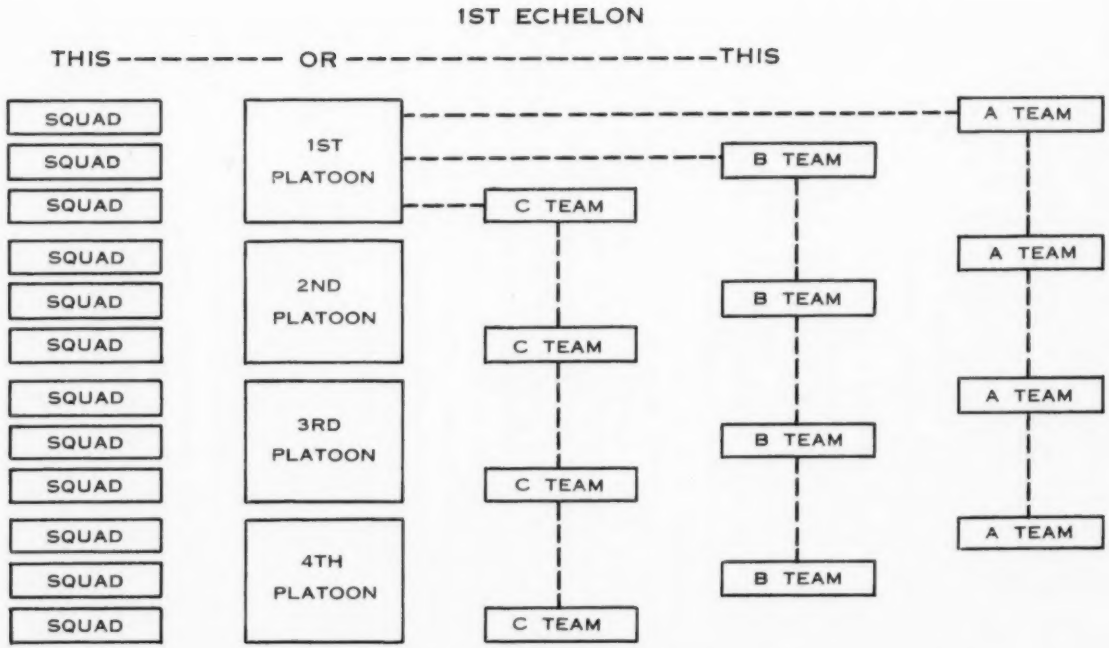


CHART NO. 2 INTRA-UNIT COMPETITION

organization of "A", "B", and "C" teams. This method of organizing teams of different classes can be used to increase the number of participants in inter-unit (inter-company) competition. The advantage of this type of organization lies not only in the fact that a greater number of men are given an opportunity to compete, but also that men of more equal ability are matched together in competition.

SPORT CLASSES

The careful selection of personnel to conduct sports classes is essential for the success of the on-duty sports class program. Men with previous coaching or physical education experience will make the best instructors; however, it may be difficult to find men in this category. Expert performers such as those men who make up the regimental or company teams will often be found capable of handling these classes in the sports in which they excel, provided they are properly supervised and guided. The instruction given in each sport will be more uniform and of higher caliber if instructional teams are organized on a regimental or battalion level. These teams should consist of one chief instructor and several assistants, depending upon the type of sport and the number of personnel to be instructed. If the organization of such teams is not practical, each company commander must use the best personnel he has available to conduct the instruction under the supervision of his officers. In either event adequate teaching plans must be set up and should include instruction in individual skills, offensive and defensive tactics, and rules of the game. The number of classes it is necessary to hold in each sport will depend upon the type of game. For example, fewer classes are necessary for instruction in volleyball than for softball of basketball. In this connection it is advisable to begin competition in all sports as early as possible after starting instruction so that men will not become bored with long and continuous practice sessions. Practice should be progressive and continue well into each season, but after the first few periods it should not take up the entire training period.

The principal instructor for each sport should be given opportunities to conduct "in-service" training for those men selected as his assistant instructors. Several such periods should be scheduled prior to starting instruction in a particular game and thereafter as often as necessary to insure progressive and uniform instruction. All assistant instructors should be given some type of lesson plan which will include the particular skills or game tactics that are to be taken up during each period and the amount of time to be devoted to each. Typical lesson plans for basketball and boxing are as follows:

BASKETBALL

LESSON I	Time Allotment
Introductory talk.	10%
Passing drill by parallel lines	40%

Explain, demonstrate, practice:
Two-hand back of ball catch.
Two-hand chest pass—air and bounce (without spins).
One hand baseball pass, right and left (air and bounce).
Two-hand underhand flip pass, right and left.

Stress:
Relaxing.
Coordinating ball release with step forward and weight transfer.
Using the left (or unnatural) hand.
Make ten drill. 25%

Explain, demonstrate, practice:
One hand under basket shot; right and left.

Stress:
Ability to use both right and left hands.
Shooting with the proper hand and taking off on the correct foot.

Spinning on foot and turning body so that both face the basket when ball is released.
End-line dribbling drill. 25%

Explain, demonstrate, practice:
How and when to dribble.
Discontinued and illegal dribbles.

Stress:
Correct form and body balance.
Ball control with left and right hands.
Split vision.
Passing ball by means of a final straight up and down bounce.
Total— 100%

LESSON II

Passing drill by parallel lines: 30%

Review and practice:
The two hand back of ball catch and all passes taught on first day.

Step and Shoot Drill: 20%
Explain, demonstrate, practice:
The take-off and execution of a lay-up shot.

Stress:
Coordinating ball release with take-off.
Ability to use the proper hand and take off on the correct foot.

End-Line Dribbling Drill: 30%

Review and practice:
Correct dribbling form.

Stress:
Form.
Ball Control.
Split vision.
Passing ball by means of a final straight up and down bounce.
Explanation of fundamental offensive and defensive playing. 20%
Total— 100%

Stress:

Defensively stress individual stance, correct footwork, and a tight man-to-man defensive position between opponent and basket.

Offensively stress the ease with which a "grounded man" is guarded, the need for moving toward ball or basket, and the use of initiative, aggressiveness, and drive.

BOXING

LESSON I

Position, Movement and Hitting Power.

Introductory talk and organization	25%
Mass Instruction:	
Drill 1—The on-guard position.	25%
Drill 2—The slow advance and the slow retreat.	
Drill 3—The left and right steps.	25%
Drill 4—The waist pivot.	25%
Total—	100%

LESSON II

The Left Jab to the Chin and Blocks.

and Blocks	
Review. The on-guard position, fundamental footwork, the waist pivot.	
Drills 1, 2, 3, 4.	25%
Mass Instruction	
Drill 5—The left jab to the chin.	25%
Drill 6—The stop.)	
)	25%
Drill 7—The parry.)	
Defensive and Controlled Boxing	
Refer to Drills 5, 6, 7.	25%
Total—	100%

Lesson III Etc.

Because competent officiating adds a lot of interest to any game, the athletic officer must make provisions for the selection and training of officials. Although the importance of having good officials increases progressively

with the higher echelons of competition, it is advisable to have men who know the rules officiate even the lowest level games. All officials should attend a short course of instruction in which the rules of each game are reviewed and the proper conduct of officials is taught. Such schools can be conducted during training time and will pay dividends in the long run.

OTHER FACTORS TO INCREASE INTEREST IN THE PROGRAM

In addition to careful planning and organization of the athletic program, there are a number of other factors which the athletic officer should consider in adding interest to the overall program. One of these is publicity. Company bulletin boards and regimental daily orders or news sheets are important means of keeping all personnel posted as to forthcoming tournaments, leagues, and other forms of individual and team competitions. Results of contests and announcements of winning teams or players can be promptly made through these channels. In this connection use of local and hometown newspapers should not be overlooked.

Exhibitions and shows primarily for spectator interest should be scheduled every so often. Water carnivals, boxing shows, field meets, sports quiz programs—conducted in the manner of "Dr. I. Q.", and other types of shows add interest and enthusiasm to the program. Make these exhibitions as colorful and attractive as possible by turning out the band, urging the high-ranking officers to attend, and by inviting civilian guests of all personnel.

Provisions for giving awards to individual and team champions, keeping up-to-date and complete records of all competition, and using point systems whereby the best all-round competitive platoons and companies can be determined, are other means of creating interest and getting the men more sports minded. No possibility should be left unexplored that will result in developing and maintaining interest, enthusiasm, and maximum participation in the physical training and athletic program.

CHAPTER 11

A Formula for Instruction

Few of us are mentally equipped to produce an original idea. Only such geniuses as Newton, Huxley, Edison, and Einstein are capable of having a really new idea; the rest of us must take the original thought developed by others and convert it to our own ends. Before we can convert this idea to our own purpose however, we must have an intermediary—an instructor. And the instructor must be someone who is capable of understanding the basic idea and also capable of transferring this idea to others.

Ideas are without value unless they are transferred. A man can have a wonderful, breath-taking, world-shaking idea; but unless he is able to transfer that idea to another person's mind, he has accomplished nothing. This transference of thought, coupled with the recipient finding the idea desirable and acceptable, is simply a complicated way of saying that an idea, to have value, must be sold.

Edison had an idea. Locked up in his brain, it was valueless. When he transferred it to others and when he made it desirable and acceptable to them, his incandescent lamp captivated the world.

Ford had an idea which, had it been confined in his brain and workshop, wouldn't have affected the life and economy of the country. But when he transferred, i.e., sold, the idea to others, his horseless carriage had real value.

What constitutes selling an idea? To sell an idea is to present an idea to the "customer" in such a way that he will find it desirable and possible to make the idea a part of his knowledge.

One man has an idea that the Blank Vacuum Cleaner is the cleaner you should buy. When he presents the appliance in such a way that you find the idea *desirable* (produces the desired results) and *possible* (within your capacity to purchase), you sign on the dotted line.

Another man has an idea that you should know how to apply immediate action to a cal. .30 machine gun. When he presents the procedure in such a way that you find it desirable (produces the desired results) and possible (within your capacity to learn), you accept the knowledge and retain it as a part of your military equipment.

Over a period of years each of us has been sold ideas on English, history, mathematics, etc.; in the Army we have been sold ideas on tactics, weapons, logistics, etc. Practically everything we know has been *sold* to us—presented to us in such a way that we have accepted it as desirable and within our capacity to use.

Since we conclude that teaching is *selling* ideas, we need a definition. What is teaching?

Teaching can best be analyzed by breaking it into three progressive steps. First, teaching is to work your pupil into such a state of interest in what you are going to present to him that every other object of attention is banished from his mind.

Second, teaching is to reveal what you have for him so impressively that he will remember it.

Third, teaching is to give to your student a devouring curiosity to know the next steps in connection with the subject and to inspire him to want to reach perfection.

To summarize these three progressive steps that will constitute our working definition of teaching, let's paraphrase a military expression:

To teach is to:

1. FIX the student's interest.
2. FILL the student's need.
3. FIRE the student's mind to go ahead.

This is the basic idea. The theory of fixing, filling, and firing can be stated quickly and rolls off the tongue with ease. However, it loses much of its simplicity when we begin to practice it.

We can approach the process from two angles. There is the coldly psychological approach that starts with white rats and is graduated to dogs and monkeys to prove why a student does or does not learn. The other approach is the one for us; it is the truly human approach. It is an attempt to know and to understand the student as well as possible, to take a friendly, helpful, intelligent attitude toward him when we teach. The student cannot be considered a specimen to be handled with forceps, he is a fellow soldier; he cannot be treated as experiment number so-and-so, he is a friend who needs us.

Therefore, before we start our teaching process, we must know our students; they must become individuals to us.

At The Infantry School, the instructors are furnished statistical analyses on the classes. These analyses include the following data on each student:

Name
Grade
Serial Number
Component
Age
Education
Military Schooling
Knowledge of Foreign Languages
Combat Service

For service school needs, that amount of information is excellent. However, for the troop leader and the ROTC instructor, several other items would certainly be added. For example:

Parent's or guardians' names
Home town
Special interests and hobbies
Religion

Your method of knowing your students must fit your needs. The only point of chief concern is that you do have all pertinent information readily available—information that makes the soldier or cadet become an individual to you.

ADULT EDUCATION

For the troop leader especially, there is another approach to this business of knowing the student that deserves consideration. It is the realization that he is working in the field of adult education. Too many of us have some preconceived but erroneous ideas about the learning abilities of adults. Our only guides, in many instances, are adages of the type that states: "You can't teach an old dog new tricks." While that quip may be true of dogs, it is certainly not true of human beings. It is imperative that we who have men in our units whose ages range from eighteen to fifty realize the fallacy of such statements.

Dr. E. L. Thorndyke of Columbia University made an exhaustive study of an adult's ability to learn. He concluded:

1. That almost anything is learnable at any time up to fifty years of age.

2. That, in general, age seems to influence the power of intellectual acquisition very much less than it influences motor skills (physical performance). For example, a man of fifty learning to drive a car would learn nomenclature, directions, precautions, and traffic rules about as fast as a youngster of eighteen. However, the man's age would probably begin to influence the speed with which he acquired driving skill and the quickness with which he reacted to meet an emergency.

3. That the difficulty expected in learning at late ages is in part due to a sensitiveness to ridicule, adverse comment, and undesired attention. The man who is ten to thirty years older than his classmates usually does receive at least undesired attention. It becomes news when he is graduated. The veteran who has re-entered school after several years of maturing experience in the Army is finding himself handicapped by undesired attention.

Therefore, we conclude with Dr. Thorndyke, that age alone is not a detriment to learning ability; and we must resolve to avoid obstructing learning among our older men by placing undesired attention on their activities and accomplishments.

Knowing and appreciating our students to the best of our ability, we are ready to approach them to get them to learn; to have them acquire skills, facts, or ideas which are new to them.

To get them to learn is to teach. And as we go through, in detail, the process of teaching, we will discuss certain laws, principles, or findings of research which will apply to the various situations. If we apply these laws, principles, and findings, we increase our chances of success.

INCENTIVES VERSUS MOTIVATION

Our first job as a teacher is to promote interest in the subject. We said before that it was working the pupil ihto such a state of interest that every other object of interest was banished from his mind. Simplified, the objective is just to make him *feel a need* for the material which we give.

There are two types of pressure which we can use to interest a student, two types of forces which we can exert upon him to make him *feel a need* to learn the subject at hand.

The first is incentives. Incentives are any external (having nothing to do with the subject) pressures which make a student want to learn. Here is a list of the most common incentives:

1. To do his duty—the student feels an obligation to the government or to himself.
2. To please others—mother, sweetheart, wife, father.
3. To join the gang—at graduation, on the rifle range, etc.
4. To win a reward—a grade, commendation, pass, pat on the back, approval, etc.
5. To escape punishment — dismissal, ridicule, poor grades.

Fortunately, these external pressures sometimes get results. These incentives that are not a part of the subject can be effective when superimposed upon the student. Just as a child may not like something to eat, a salad for instance, after he is persuaded to eat it, he may like it and begin to want it. The good has been accomplished. Castor

oil, whether taken because of the incentive of a paddle or because the child wants it, is equally effective once it is taken. Our conclusion on the use of incentives is that the use of external pressures is permissible if the end justifies the means, i.e., if the thing to be learned or if the skill to be developed is of such importance that it justifies relying on the use of incentives.

Before we say to ourselves, though, that the importance of what we have to teach is so great that we are justified in using incentives, let us consider two very definite disadvantages to relying on them.

The first disadvantage is that learning promoted by incentives is usually of a temporary quality, liable to fade quickly as soon as the incentive is removed. How often we have made ourselves remember things until a graded test and then promptly forgotten them!

The second disadvantage to relying on incentives is that learning promoted by incentives is liable to set up attitudes of hostility, to make the student antagonistic toward the activity and to those who forced it. Think of something which you have been forced to do. Think, too, of your opinion of the person who forced you to do it.

A friend of mine has a beautiful medal which he was awarded when he was a boy for having attended Sunday School for three years without missing a Sunday. He says, though, that the medal should have had an engraving of his father's razor strap on the back; for without the incentive furnished by that homely object in his father's hand, he would never have received the award. His evaluation of this experience is that he has today a feeling of hostility toward Sunday Schools in general and an antipathy to those individuals that are associated with them.

In the Army we are engaged in teaching military subjects. We cannot afford to have our men learn just for today; we are training them for the future. What they learn now must be retained for use in an emergency. If their skills and knowledge are of a temporary nature, then

we have failed in our objective of setting up a well-trained reserve. The remark, "I have forgotten what I was taught," explains but does not excuse casualties.

Further, you and I are engaged in making friends for the Army both within the ranks and in civilian life. The recruit, the drafted soldier, the civilian soldier of the National Guard or Reserve, the ROTC student—all these are going to be touched by our instruction. Shall we do as we have done too often in the past—give an order, "Learn this!", and be unmindful of resulting attitudes toward military training and all who are engaged in it? We cannot afford to make this fundamental error!

Before we become overawed by the seriousness of our subject and by our own importance in the Army training plan—before we set our jaws and say, "The end justifies the means", let's look at an alternate type of pressure which we can employ to make a student *want* to learn.

This is a kind of pressure that promotes learning and is more effective and more continuous in its effect. It is called motivation. Motivation is intrinsic with an activity, it is inbred, a real part of the experience. Motivation is the *desire* felt for something by the one who is to act.

When a learner knows the purpose of the experience which is offered to him, when he approves it as desirable and accepts it as his own, we call that true motivation. The most powerful motivation, the most potent drive a learner can have is gained from a *consciousness of need*—a feeling down deep inside him that he ought to know what we are about to teach him.

Here are three ways in which a student can get to feel this need:

1. *Personal experience.*—Let's suppose that you are teaching scouting and patrolling. If a student in your class saw several of his squad become casualties in combat because of violation or ignorance of the principles of scouting and patrolling, he has acquired a need by personal experience. This experience can be gained in exercises and maneuvers as well, with only a lesser degree of intensity.

2. *Testimonial experience.*—Next to personal experience, the best way for a need to be developed is by the instructor revealing that need. Combat examples can be given. A vivid mental picture will show a need. If an instructor has a strong enough personality, it is possible that his personal testimony that the student needs the subject is sufficient to create a motive.

3. *Hypothetical experience.*—Finally, a student can be put into such a position that the need will emerge automatically. For instance, a diagnostic test can be given at the start of a class or a series of classes which will convince the student of his ignorance and automatically create a need in his mind. In a similar manner a student can be made to realize a need by projecting him into a hypothetical situation.

Let's take a concrete example and follow it through all three stages of the creation of a need. We want to impress on the students the need for their learning immediate action for the machine gun:

1. Some of the students will have had a jammed gun in combat or will know of someone who had a disastrous experience because a gun failed to fire. That group will have a motive for learning that comes from personal experience.

2. Other students will be motivated by testimonial experience, combat examples that an instructor can relate illustrating the seriousness of the situation in combat when a man cannot keep a gun in operation.

3. Still other students will need to be set down behind a gun which has a stoppage and told to fire it. The students realize their helplessness, and thus receive a learning motive from hypothetical experience.

A very elementary fact in this connection is that the more appeals we make to develop a real need in the student's mind, the more we increase our chances of success.

Thus we have then two ways in which to fix the student's interest on the subject—incentives and motives, with motives the stronger because that need comes from within the person, has a more lasting quality and offers more personal satisfaction.

It is in the introductions to our presentations that we set up our incentives and motives. We must open the furnace door before we start trying to shovel in the coal. We must open the shutter before we try to take a picture. We must have the students open their minds to us and be ready to receive what we have to offer.

Let's assume now that we have the students' interest—that we have established a need. We have accomplishd the first "F".

FILLING THE NEED

The second step in good teaching is to present our subject so impressively that the student will remember it. In other words, fulfill the need that we have established, answer that interest which we have created. We must accept the responsibility to produce something worthwhile.

Have you ever gone to a circus sideshow which displayed a fancy front and a fascinating barker, both promising a fine show; and then when you got inside you found that all they had was a moth-eaten monkey, a bear in hibernation, and a retired sailor displaying his tatoos? Did you ever attend a highly advertised fireworks display in your home town and then have the show turn out to be a fizzle? These are two examples *not* to emulate.

You must give something worthwhile. There is a need there and an interest that must be answered. Our subject matter comes from directives and manuals. The techniques of presentation we will develop or have developed through self-analysis, instruction, and experience. So let's concern ourselves chiefly with some of the principles which will help the student retain what we have for him; that will assist us in impressing our subject on him so that he will remember it.

To retain what we have for him, the student exercises his memory—not the kind of memory that recalls what he had for dinner yesterday, but rather memory as a habit. We say that a habit is a tendency to respond (either mentally or physically) in a definite manner. We have both mental and

motor habits. Operating a machine gun requires both kinds. Mental habits place the gun in the correct tactical position for firing; motor habits take over to operate the piece and to apply immediate action.

A myriad of factors can influence the permanence of memory. Let's consider a few of them.

One important factor is the *vividness* of the experience. A child that has been burned has a more vivid memory of the fact that a stove is hot than has the child that was merely told. In teaching, if we can dramatize an experience, we can better impress an idea. To assess casualties, to take prisoners, and to use demolition charges to simulate shell fire—all of these tend to impress the lessons to be learned from the training. Vividness is also expressed in terms of realism. The army went to great pains to obtain plastic and rubber forms to fit over sound limbs and bodies to make simulated casualties seem more real. An aid man in training with this equipment works on a live man who appears to have a gaping wound or who seems to have a piece of bone (plastic) sticking out of his arm as a result of a compound fracture. Vividness impresses the subject and makes it easier to remember.

The permanence of our memories is affected by the resultant *satisfaction* that was gained by learning. If the learning of how to shoot a rifle gave the student real pleasure, if it built him up in the eyes of his buddies, if it earned him an award, the resultant satisfaction aided his remembering what he had learned. All of us remember things that are associated with pleasantness.

It seems obvious that if we can have students say at the close of our presentations, "I enjoyed that class," what we have taught is more likely to be retained in their minds.

SENSORY APPEALS

Any discussion of this type must include a consideration of sensory appeals—the relative strengths of appeals made to the five senses. One psychologist has set up these strengths like this:

Smell	-	1½%
Taste	-	1½%
Touch	-	2%
Hearing	-	10%
Sight	-	85%

We who have believed in training aids, films, and film strips for years are ready to agree with the author of the above table. We know that we have increased our chances of success in teaching when we have used aids that had eye appeal. But, too, each of us has experienced difficulty in getting or preparing training aids. So, based on the experience of others, many of us have learned to have the students build the aids *mentally*. A good instructor using descriptive language and drawing upon the experience of the students can get them to form mental pictures and diagrams that are the next best thing to the object itself.

To illustrate, let's suppose that you saw in a current magazine a picture of an experimental model automobile which you wanted to describe to your class. Of course the simple thing to do would be to use the opaque projector and flash the image on a screen. But lacking the equipment, you proceed to have the students build the picture, i.e., the training aid, in their minds. You tell them that:

1. It is about the size of a ¼-ton jeep.
2. It uses four motorcycle type wheels.
3. Its fenders are those of a miniature Buick automobile.
4. Its headlights are comparable to those of a 1941 De Soto.
5. Its top is of transparent plastic which is shaped like the cockpit covering of a fighter airplane.

Having called to mind certain familiar mental pictures, you persuaded the students to put them together to build a training aid which you were unable to show them. From this mental picture each student has learned to recognize this experimental model car. By using the *students' experience* you have taught a new idea.

To teach this new idea you have appealed through the

sense of hearing, but have also utilized the sense of seeing. Just where exactly in our table of relative strengths this type of sensory appeal belongs is a debatable question. However, we certainly are agreed that it is stronger than an appeal only to the ears, and only a little short of a picture projected on a screen. Again, we have increased our chances of success as instructors.

EMPATHY

A new name for an old idea is the word *empathy*. The dictionary says that it is *the imaginative projection of one's own consciousness into that of another being*. Actually it is very simple. Most of you have gone to a grunt and groan wrestling match. Get a picture of two fuzzy-chested, mobile-muscled mammoths tugging at each other. Haven't you found yourself helping—twisting and turning in your seat, trying to break that hold? That is empathy—you have by imagination become a wrestler and crawled into the ring. You experience some of the mental and muscular anguish of the wrestlers. Haven't you heard someone say after the bout, "That just wears me out"? Have you ever watched the face of a person who is listening to a stammerer trying to speak; have you seen his face twist and his lips move trying to help the other man get the words out?

In teaching we want to try to take advantage of that imaginative projection. Keep in mind that when you are before a class, each student, in varying degrees, is working with you, depending of course on how you have concentrated his attention. If you are enthusiastic, so is the student. If you are lethargic and dull and bored, your actions and attitude will be reflected by the class.

Being conscious of empathy and what it can do will certainly tend to make us more attentive to our platform technique.

So in the interests of presenting the subject so impressively that the students will remember what we give them, we have considered (1) the vividness of the presentation,

(2) the influence of sensory appeals with its accompanying use of mental pictures, and (3) a recognition of empathy as a basic human characteristic with which we must cope. These three are only representative of a multitude of factors affecting retention. But full utilization of these will increase our chances of reaching our 100% effective teaching goal.

Let's say that we have filled the need felt by the student, that we have given him what we have for him in such an impressive manner that he will retain it.

FIRING THE MIND

We have left only the last F—Firing The Mind, i.e., giving the student a devouring curiosity to know more of the subject. Professor Thomas H. Briggs of Teachers' College, Columbia University, states what he calls the "Golden Rule of Education." He says that it is a teacher's duty to reveal higher and more advanced activities and to make them both *desired* and *possible.*

This is the inspirational part of teaching; firing a student's mind to the extent that he wants to know more or to become more expert. We can't instruct students until they perfect techniques and skills, but we can inspire them to go on to perfection. It is an ideal; something up in the clouds, perhaps; but it is a very real goal that can be accomplished in a small way if our first two F's are well done.

Emerson's remark, "Hitch your wagon to a star," assumes that the student can see the stars. It is our job as instructors to point out the stars, the goals which are *desirable* and *possible* towards which our students are to strive. Unfortunate, indeed, would be the young soldier to whom we taught map reading who could not visualize the cartographer's, the photo interpreter's, or the surveyor's field ahead of him. Those to whom we teach scouting and patrolling must have pointed to them the road to expert intelligence, observation evaluation, or the ramifications of special mission assignments.

The goal must always be ahead; a goal reached ceases to be a goal. A soldier without a goal toward which to work is a disinterested soldier. We have the responsibility of pointing out the goals for the soldier. It is an integral part of our job as instructors.

GI has stood for many things in the Army. Let's use it once more and let it stand for *Good Instruction.*

$$GI = F + F + F$$

Good instruction means to *fix* the student's interest, to *fill* the student's need, and to *fire* the student's mind to go ahead.

This is the goal!

CHAPTER 12

Preparation and Conduct of a Field Exercise

PART 1

FOREWORD

The ultimate goal of all military training is efficiency in combat. The infantryman prepares for the day he must kill or be killed—the day he will call into play every principle taught over long training periods. These training periods will emphasize training in tactical doctrine, followed by its application under assumed, outlined, or represented situations which simulate, as closely as possible, the conditions of actual war. The value derived from this training will vary directly with the realism with which the battle conditions are simulated. *A well prepared field exercise is the closest approach to the conditions of actual war.*

Definition. "Field exercises are exercises conducted in the field under simulated war conditions in which troops and armament of one side are actually present in whole or in part, while those of the other side are imaginary or outlined." (FM 21-5, Par. 105*h*.)

1. GENERAL.—A field exercise serves its purpose only if the author prepares it carefully in the form of a situation in which the enemy is represented, if it is controlled by umpires and executed with force and determination as one coherent operation, and if it is terminated with a comprehensive and well planned critique.

2. DIRECTIVE.—*a.* A field exercise is usually initiated by a training directive from higher authority. A training directive for a small unit exercise is usually initiated by a company or battalion commander.

b. The commander issuing a directive bases its development on the following considerations: (See Directive, Part II.)

(1) The progressive steps in training. For example, when specific abstract doctrine has been taught, tactical exercises requiring the application of this doctrine should follow.

(2) The deficiencies observed in previous training. For example, if methods of control within the particular unit had been ineffective, the directive would emphasize training in this principle.

(3) The terrain available for the conduct of the exercise.

(4) The time and place of the exercise.

(5) The availability of special equipment and ammunition.

c. It is intended that the directive be a single source providing all the information necessary to plan the preparation of a particular exercise. By analysis of the directive, the purpose and scope of the exercise is established.

(1) *Purpose.* The purpose of an exercise states briefly the nature of the exercise and its objective. (See Part II. Par. 1*a.*)

(2) *Scope.* The scope is closely correlated with the purpose, but presents in detail the training principles prescribed by the directive, to be included in the exercise. (See Part II, Par. 1.

3. PLANNING THE EXERCISE.—*a. Reference material.* The preparation of any tactical exercise must be careful and thorough. It is presupposed that the author becomes thoroughly familiar with the contents of pertinent training manuals before planning the exercise in detail. The purpose of a preliminary study is to refresh the knowledge of established principles and to become acquainted with new developments. The author will compile, in brief form, the titles and paragraph numbers of training manuals, circulars, bulletins, and regulations bearing on the subject

of the exercise. This compilation provides a suitable reference for the author in the detailed preparation, for troops that will participate in the exercise, and for control personnel or observers of the exercise.

b. Reconnaisance. A preliminary study and reconnaissance of the allotted terrain should be made as soon as possible, and before the tactical situation is developed in detail. In an analysis of the terrain the primary consideration is how to best illustrate the tactical principles to be exemplified by the exercise. Based on this decision, the tactical plan of the exercise is determined and is divided into phases, each designed to illustrate definite tactical principles. Each phase will be a logical development of the preceding phase and will present the best possible situation to illustrate the tactical principle or principles.

c. Influence of the terrain. To emphasize the influence of the terrain on the tactical plan of an exercise a more detailed discussion follows:

(1) *Terrain analysis.* Prior planning for a reconnaissance includes the following: reservation of the terrain, a precautionary measure to assure that the area is free of firing and is not in use by other troops; securing of equipment needed to facilitate the reconnaissance, to include a map or sketch, compass, binoculars, and sketching materials. The actual reconnaissance is initiated from a vantage point where the map or sketch is oriented to the terrain on which can be best illustrated the principles to be exemplified by the exercise, such as corridors for attack and cross compartments for defense. Plan situations that provide the desired training and after establishing a tentative plan turn your attention to the details that effect the plan. These details will include the following:

(a) The initial location of the participating unit must be established. This location should have the characteristics of a similar location under combat conditions. If it is an assembly area, as in an attack situation, it should be defiladed and concealed from ground observation. It should be located so as to be convenient to favorable routes of advance to combat positions.

(b) The actual location of the enemy must be definitely established on the ground. For each phase of the exercise the fires of the enemy must be prescribed and close control planned. The fire of the enemy must be appropriate to the size of the unit represented. Whether the enemy is represented by actual troops, flags, targets, or other means, realism is an essential consideration.

(c) Control plans for the exercise must be among the early considerations. As the tactical plan is developed, consideration must be directed to a plan to assure that the exercise will progress in accordance with the planned situations. For example, an enemy installation such as a mine field might be simulated to restrict movement and to force an action at a predetermined location. Obviously the planned situations will only be effective if they are approached and solved in accordance with the anticipated action.

(d) The tactical plan of the exercise will require much attention to detail. The initial reconnaissance must include actual visits to all prominent terrain features in the allotted area to assure that the terrain is used to the best advantage and that situations are tactically sound. Details such as the line of departure, routes of maneuver, positions for bases of fire, observation posts, assembly areas and weapons positions must meet tactical requirements and each must logically fit into the overall situation. It is especially important that the location for orientation of the participants be such that relevant terrain is plainly visible. Normally the unit leader is oriented at a vantage point and the remainder of the unit familiarize themselves with the terrain by a reconnaissance initiated by the unit leader. Other details such as sites for critique, safety limits for firing, location of range flags, placing of range or road guards, and target locations will be discussed under other headings.

(2) *Sketch.* During the reconnaissance mental notes are essential but in addition, certain information must be recorded in the form of a rough sketch. The sketch should be prepared while actually on the terrain and the details,

as necessary, of the exercise plan should be recorded. Thus errors in the exercise as related to the terrain are more likely to be avoided. The rough sketch and the exercise plan can be improved later. At this point it is well to review the plan made thus far to be sure it is sound. With notes and sketch in hand these questions should be asked about the exercise as planned:

(a) Is the exercise tactically sound?

(b) Are the enemy dispositions and strength in the planned situation comparable to those to be expected under combat conditions?

(c) Does the exercise illustrate and properly emphasize each of the tactical principles it is desired to present?

(d) Does the exercise satisfy the requirements of the original directive?

> Note: On the sketch identify enemy dispositions and installations by numerals and those of friendly units by alphabetical letters. (See Part II, Sketch.)

4. DRAFT OF THE EXERCISE.—*a. Reconnaissance.* Only after a thorough reconnaissance is the author prepared to draft the exercise and even then it is likely that frequent references to field manuals and the sketch will be made. The influence of the terrain on the exercise cannot be overemphasized.

b. The general situation. The general situation first states the facts known or assumed to be known to both the friendly and enemy forces. It is an orientation which states the facts that would be known if the exercise were actually a combat situation. The general situation assists the participant in assuming his place in the exercise and provides a logical background for the action that will be initiated by the initial situation. Normally, the general situation will acquaint the participant with the activities of the next higher unit that will have effect on the action that will follow. The location and disposition of the participating unit should be included. Care must be taken to

avoid inclusion of non-essential data. (See Part II, Par. 5*a*.)

c. The initial situation. The initial situation should be so designed that its logical solution will properly initiate the exercise along the desired lines. It must be logical and as brief and simple as possible, yet include all the information necessary to the accurate solution of the problem. It must be presented in such a way that the element of surprise will not be eliminated. The initial situation should conclude with a message, an order, or a statement of a particular enemy threat or action, which will force the commander of the unit to make a decision, to execute a decision that has been made, or to do both. (See Part II, Par. 5*b*.)

d. Additional situations. Normally the solution of the initial situation will not include all the action necessary to comply with the requirements of the directive. Further training requirements can be accomplished by introducing additional situations for the participant's solution. Additional situations must be logical developments of previous situations and so designed to provide training in definite requirements of the directive not covered in other situations. Concurrent situations are a means of accomplishing training requirements. The nature of a concurrent situation is such that it can accomplish its purpose without introducing an entirely new situation. They are superimposed on one or more of the major situations. An example: denying a unit the use of a major communication agency to test efficiency in the use of a secondary agency. In this example the training requirement would be accomplished without materially interfering with the situation already in progress. The combined situations should be designed to cover the training requirements of the directive only and care must be taken to assure the exclusion of principles not included in the scope. (See Part II, Pars. 5*c*, *d*, *e*, *f* and *g*.)

e. Requirements and solutions. All situations must have at least one requirement with an accompanying solution. Requirements are designed principally for the unit leaders and their subordinates who are participants in the exercise. They should be brief and indicate clearly what

is expected of the participant. The solution to each requirement, prepared by the author, will establish a standard by which the efficiency of any unit running the exercise can be determined. Drilling into troops certain combat missions, presenting standard solutions, and declaring such solutions to be the only correct ones should be avoided. Care is taken that combat missions are executed according to recognized principles and doctrine, and not according to hard and fast rules. Almost any requriement has more than one logical solution. Principal considerations in a solution are: the manner of execution by the troops of the assigned mission in the tactical situation presented to the leader, and the leadership displayed by the commanders.

6. CONTROL.—*a. Umpires.* Field exercises are regulated and controlled by a group of umpires under a chief umpire. The author of the exercise may be the chief umpire, and normally is, or another officer may be designated. Umpires should be selected from the best officers and noncommissioned officers available. It is desirable that umpires be senior to all personnel of the unit they are umpiring. In no case may the officer directing the exercise be the one who commands the troops during the exercise.

b. Hostile forces. Umpires represent the hostile force, the imaginary superior commanders of the participating unit, and any imaginary suporting or neighboring unit. They control the exercise by giving information of the enemy; by initiating messages and orders supposedly emanating from higher authority or from neighboring or supporting troops; and by rendering decisions relative to the effect of hostile fire, casualties, and generally, determining such questions as are decided in war only with bullets. The number of umpires required by a particular exercise will be determined by the type exercise, the size of the participating unit, the control plan, and necessary observation of performance of individuals and units. All umpires and control personnel must be familiar with the situation

and requirements prior to the running of the exercise. This is accomplished best by a rehearsal on the terrain upon which the exercise will be run.

c. Methods of control. Small unit exercises may be controlled by one or more of the following methods:

(1) *Control flags.* These will be used in accordance with principles outlined in par. 9, FM 105-5. In an exercise employing control flags all participants must be familiar with the meaning of each flag and must react promptly when a flag is displayed. Normally every contact between opposing forces will require a flag be displayed as the participant will rely on this type signal to determine his situation at a given time. Control flags properly used provide combat realism.

(2) *Personnel and vehicle identification.* These will agree with those outlined in par. 8, FM 105-5. The use of distinctive markings facilitate recognition of opposing forces, however marking should be so designed that identification is no less difficult than in actual combat.

(3) *Enemy representation.* In non-firing exercises the enemy should be represented by at least a few troops, although it may be necessary to supplement them with flags, targets, and simulated firing. Flags may be used to indicate the flanks of an enemy position or they may be used to indicate the progress of adjacent units. Targets are used to represent enemy positions, weapons, and vehicles. If properly used targets can be very realistic. Normally targets are partially concealed to add combat realism and in firing exercises they may be completely concealed and used to test fire distribution in a prescribed target area. In the firing exercise targets and flags will be the principal enemy representation. These provide little realism and if possible, charges of explosives, fire crackers, and remote controlled weapons fire should be introduced to increase realism in the exercise.

(4) *Communication.* A communications system for use by the umpires in controlling the exercise must be provided. The communications system for a small unit exercise need not be elaborate. The equipment necessary will normally

be found within the company or battalion. If it provides communication between umpires, enemy, and the participating unit, a system using one or more of the following may be employed: arm-and-hand signals, flag signals, radio, telephones, pyrotechnics, and sound signals. All firing exercises must have an emergency signal for halting the exercise, the most satisfactory being a sound signal. The sound must be one which is not common to the area.

(5) *Troop orientation.* If troops are expected to react to the control methods of the exercise a detailed orientation must be provided. The troop orientation should include the general situation, identifications, flag signals, methods of enemy representation, and safety rules. The detailed orientation to the terrain will normally be accomplished as part of a tactical situation, such as a reconnaissance or an orientation in conjunction with the issuing of an order from a vantage point. (See Part II, par. 6*d*.)

7. CRITIQUE.—*a*. A critique is a discussion and review of a military exercise bringing out errors and successful performances. The critique should consist of a brief review of the tactical doctrine involved and its application to the exercise.

b. When the exercise has progressed to its conclusion, or has reached a point where no further benefit can be derived, the chief umpire should notify the unit commander and have the troops assembled for the critique. More than one critique may be held for an exercise, but it is not advisible to interrupt the continuity of the exercise unless further progress will be of no benefit due to a state of confusion or an improper solution of a situation. The critique of all small unit exercises should be conducted at a location from which the terrain on which the exercise was run can be seen. The critique should be restricted to the major principles which the exercise was designed to illustrate and should be definitely limited as to time. Both good and bad points of the exercise should be discussed.

Critiques must be of a nature that will neither cause subordinates to lose confidence in their leaders, nor cause leaders to lose self confidence.

c. At the beginning of the critique, the chief umpire should outline briefly the purpose of the exercise, the initial situation, and the developments as it progresses. Actions which were well carried out should be freely praised. Similarly, those which were poorly executed should be criticized, avoiding unnecessary identification of individuals or specific units. The umpires favorable or unfavorable comments should be supported by reference to specific actions of the unit. When a tactical error is pointed out, the probable consequence of such an error in combat should be explained and a better solution suggested. A critique should be concluded with a summary stating whether or not the purpose of the exercise has been accomplished.

d. The author of the exercise should provide each umpire with a check list which establishes a standard for evaluating the actions of the participating unit. The umpire's check list will normally be designed to stress in detail the training principles prescribed by the directive. (See PartII, par. 7*a*.)

e. The critique is conducted only by the chief umpire with the aid of the check lists collected from his assistants. This lends control to the critique by eliminating contradiction and repetition among speakers. However, should a question arise concerning an action not witnessed by the chief umpire, he is permitted to refer the question to an assistant qualified to answer the question.

f. A scoring system which provides a numerical rating is desirable in all field exercises. The scoring system is developed by giving weights to the training principles the exercise is to cover with a proportion established depending on the importance of the principle. Such a scoring system would indicate the degree of efficiency of several units running the same exercise, and in addition, provides a permanent record for determining progress of a particular unit. (See Part II, par. 7*b*)

8. TIME BREAKDOWN.—The nature of a field exercise is such that to accomplish its purpose, several closely related phases will be assembled to make up the complete exercise. Troop orientation, each situation, and the critique are definite phases of the exercise. Each has a definite objective, and each varies in importance. To assure a running time consistant with the importance of each phase, a time breakdown is employed. As each phase is developed the running time of that phase must be considered since the running time of the combined phases must equal the specified running time of the exercise. (See Part II, Par. 8.)

9. ADMINISTRATIVE DETAILS. Prior to the conduct of a field exercise there are many administrative arrangements to be made. The following are examples of administration that will be necessary:

a. Terrain reservations. Terrain should normally be reserved for reconnaissance, orientation of umpire and control personnel, rehearsal of the exercise, and the actual running of the exercise.

b. Safety precautions. Based on AR 750-10, and on local garrison regulations, the safety plan for the exercise is determined. In a firing exercise safety officers will be employed to enforce the safety precautions. Normally they will have no other duties in the exercise. The number needed will depend on the weapons used in the exercise, the size of the participating unit, and the difficulty of control due to dispersion of troops or type of terrain. Regulations will require a range flag be displayed at a prominent point in all areas where fire is being delivered. If not already erected in the area, the range flag will have to be placed before the exercise is conducted. Safety precautions will include an emergency evacuation plan, the details of which must be known to all concerned.

c. Materials and ammunition. It will be necessary to request and secure all materials and ammunition needed in presenting the exercise. The preparation of requisitions requires a great deal of attention to detail. For example, ammunition requirements will vary with every type exercise

depending on the principles being stressed. If the duties of scouts are to be emphasized it is likely that they will be issued an increased amount of tracer ammunition and similarly the other principles will have to be considered in making the ammunition request. Requests for ammunition and materials will be made through normal channels.

d. Personnel. The following remarks will apply to all personnel participating in the exercise:

(1) The time and place to report should be decided upon and made known to all concerned.

(2) Uniform, equipment, and identification must be specified.

(3) Transportation and mess arrangements must be determined and made known to all concerned in ample time for proper execution. (See Part II, Par. 9.)

PREPARATION AND CONDUCT OF A FIELD EXERCISE

PART II

THE GUN PLATOON IN SUPPORT OF A DAYLIGHT ATTACK

This tactical exercise is taken directly from the Vault Files of The Infantry School. If utilized for training troops in the field the exercise should be planned and coordinated on the regimental level because of the large number of personnel required to set up and umpire the problem. In this manner all of the regimental gun platoons can take part in the problem as test units and can also be utilized in the administrative phases while other platoons are being tested.

HEADQUARTERS
1ST BATTALION, 1ST INFANTRY REGIMENT

SUBJECT: Directive
TO : .....

1. You are directed to prepare a combat firing exercise involving the Gun Platoon of Company D in the support of a daylight attack. The exercise will be based on the company attack order. The situation will be developed so as to provide training in the following:

a. Reconnaissance of the terrain. (emphasize)

b. Selection of primary and alternate firing position areas by the platoon leader.

c. Issuing initial orders. (emphasize)

d. Formulating plan of action. (emphasize)

e. Engagement of assigned targets and targets of opportunity.

f. Movement of each weapon to alternate firing position area.

g. One displacement, by elements of the platoon, to assist in the advance of the attacking echelon.

h. Resupply of ammunition.

2. Time and place of the exercise: From 0800 to 1100, 1 May 46, in the SACKETT HILL area.

3. Limitations on the terrain: The area available for the exercise will be that bounded by IVY ROAD on the East; FIRST DIVISION ROAD on the South; GRID LINE 1421 on the West; and GRID LINE 1022 on the North.

4. Arrangements for use of the area will be made through the battalion S-3.

5. All members of the Gun Platoon Company D will participate, and all organic transportation will be available for use.

6. Direction of fire for service ammunition will be generally east.

7. Ammunition available: 35 high explosive rounds per gun.

By Order of the Battalion Commander:

EDWARD M. HILL
Captain, Infantry
S-3.

G-1, G-2, G-3, G-4, Initial targets.

5 Enemy self-propelled mount.

A Location of platoon at start of exercise.

B Initial platoon firing position area.

C Platoon firing position area after displacement to alternate positions.

D Squad firing position after displacement.

E Platoon assembly point after displacement.

F Squad firing position after displacement.

G Squad firing position after displacement.

H Road guard.

I Squad firing position after displacement.

R Location of reserve company.

X Platoon vantage point.

Y Platoon observation post.

Z Company D vantage point.

101, 102, 103, 104, Artillery concentrations.

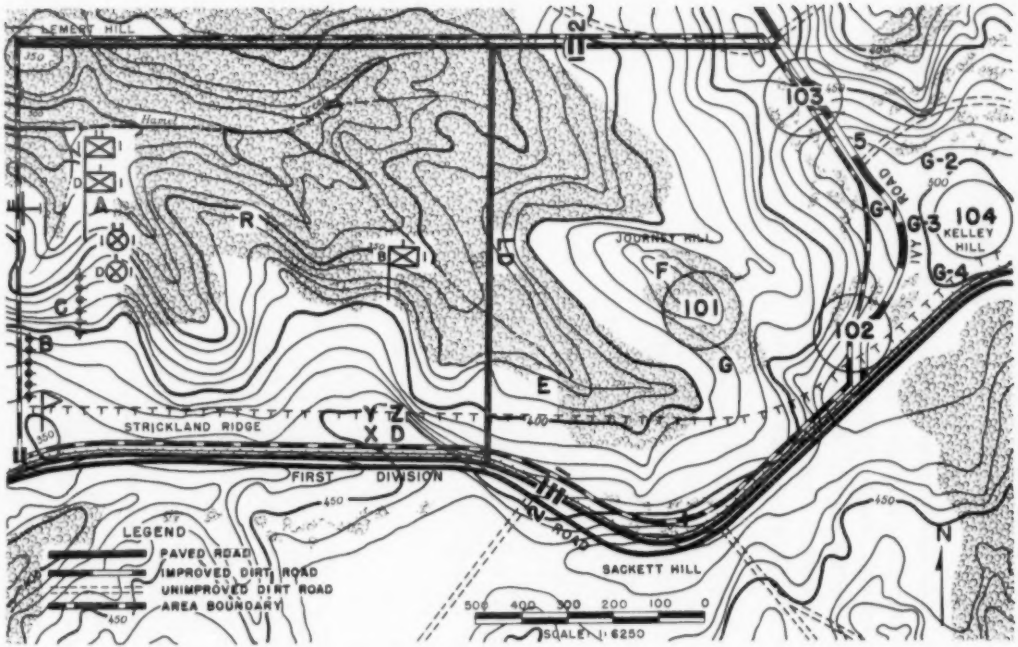


FIGURE 68.—Map of problem area.

A GUN PLATOON IN THE SUPPORT OF THE ATTACK

1. DIRECTIVE.—*a. Purpose.* The purpose of this exercise is to train the gun platoon to develop teamwork in support of a daylight attack under simulated combat conditions.

b. Scope. See paragraph 1 of preceding sample directive.

2. REFERENCE MATERIAL. The following references are pertinent to this subject:

War Department Training Circular No. 25, 13 June 1945.
Army Regulations 750-10.
FM 105-5, Umpire Manual.
Extract of Garrison Regulations, Par. 59, 61, 63-70.

3. RECONNAISSANCE. To be executed 24 April 46, to confirm map and prepare sketch.

4. SKETCH. Attached. (See figure 68.)

5. DRAFT. *a. General situation.* The bridgehead, established last night on the east side of the CHATTAHOOCHEE RIVER, is not considered secure until the enemy is denied the use of CUSSETA ROAD for troop movements. Higher headquarters orders the attack be resumed at 0900 this morning. The main effort will be made along FIRST DIVISION ROAD.

The Gun Platoon Company D is now located in its assembly area at Point A. The platoon leader is now in the vicinity of Point Z, being oriented on the sketch and on the terrain by Captain Company D prior to receiving the attack order. The time is 0800.

b. Initial situation. Captain Company D issues the following attack order to Lieutenant Platoon Leader, Gun Platoon:

"Patrols report the enemy organized principally as a strong point covering FIRST DIVISION ROAD. The major enemy force appears to be on the high ground in the

vicinity of that part of IVY ROAD in our zone. Definitely located enemy positions are plotted on the map I shall give you.

"The 3d Battalion advance was stopped at daylight this morning when it moved out of close supporting range of our artillery. The artillery is now in position on this side of the river and will support the attack with concentrations shown on map from H-15 to H+10. The 1st Battalion will pass through the 3d and continue the attack. The attack is coordinated with the attack of adjacent units. Companies A and B will be in the attack echelon. Company A, on the left, will be supported by the weapons of Company M. Our mortars will fire concentrations from H-15 to H + 10. We can expect ample warning of an enemy armored threat from our observation aircraft.

"This company will support Company B. See sketch for boundaries. The line of departure will be that line now held by the 3d Battalion. H hour is 0900. Initial battalion objective is KELLEY HILL.

"The gun platoon will fire preparation fires from H-3 to H on known enemy emplacements indicated on sketch by G-1, G-2, G-3. At H hour they will concentrate their fires on the enemy strong point indicated on sketch by G-4; also engage targets of opportunity. For initial position area, see sketch. Plan displacement to provide close support at all times. Either direct or indirect fire methods will be used.

"Ammunition for preparation fires will be placed on position prior to H hour. Battalion and company ammunition supply point, see sketch. Battalion aid station in draw south of LEMERT HILL. Weapon carriers are released to platoon control now.

"Signal to lift fire will be two (2) Amber Star Parachute flares. Gun platoon call on the 300 radio will be CURVE-4; no change in frequency. Three CE-11s are assigned to the gun platoon.

"Battalion and company command posts—see sketch.

"I will be with the battalion commander at the forward observation post.
"The time is now .....
"Any questions?
"Move out."

(NOTE: The above situation is designed to provide training in the following requirements of the directive: reconnaissance of the terrain, selection by the platoon leader of primary and alternate firing position areas, plan of action, and initial orders.)

(1) *Requirement.* Actions and orders of leaders.

(2) *Solution.*

(a) The platoon leader should plan a reconnaissance based on map study and select a vantage point. He should then send a written message to the platoon sergeant containing the following:

1. Instructions for alerting platoon for movement into positions.
2. Orders for the platoon sergeant to draw 150 rounds of ammunition, in addition to basic load, for preparation fires.
3. Release of weapon carriers to the platoon.
4. Reference to battalion and company ammunition supply point on sketch.
5. Information as to where platoon leader can be reached.

(b) The platoon leader should send for his squad leaders and orient them to the terrain and give them pertinent extracts from the company attack order. They should then make a planned reconnaissance. The platoon leader should estimate the situation and formulate his plan. He should issue an order to cover the following:

1. Pertinent enemy information.
2. Location and mission of friendly units that affect the plan.

3. Platoon mission, each squad mission, boundaries, time of attack, line of departure and other information of a general nature that affects the plan and pertains to the mission.
4. Specific orders to each squad to include: squad missions, number of guns to be employed in the preparation, duration of fires, target assignments, firing methods, safety limits of fire, primary, alternate, and supplementary position areas, and time for and order of movement to positions including time for registration (if any).
5. Placing of ammunition on positions, location of company command post and ammunition supply point, location of battalion aid station, and any other administrative details.
6. Pertinent references to signal operations instructions and location of platoon command post and observation post.
7. Synchronizing of watches.

(c) The platoon leader should then send his squad leaders to reconnoiter the terrain from the assembly area to positions. He should direct them to lead their squads into position when the rifle troops have cleared the area.

(d) The platoon leader should now return to the vantage point, which is at Point X, and check on the progress of movement and occupation of positions to determine how soon the platoon will be ready to fire. He should notify the Captain Company D when the platoon is ready to fire. When all is in readiness, he should search for targets and new enemy developments, check communications, and complete his plans for displacement.

(e) After receiving the attack order and concluding their reconnaissance and estimate of the situation, the squad leaders should formulate their plans. Then they should return to their squads, searching for covered routes. They should issue pertinent extracts of the attack order to their squads, check equipment and ammunition, lead their squads

into position, check the lay of the guns, man their observation posts, check communication (if wire has been laid), and register (if time allows).

(NOTE: At the conclusion of this occupation phase, a critique and review will be held at Point B (the first firing position area). For subject of critique, see Par. 7, CRITIQUE.)

c. Second situation. The preparatory fires are completed and Company B crosses the line of departure on time. Enemy artillery fire commences to fall on FIRST DIVISION ROAD in the vicinity of Point B. This is indicated by an umpire placing a control flag (red with a white center) near the area at H + 2. Five minutes pass and the chief umpire informs the platoon leader that the platoon has sustained two casualties.

(NOTE: The above situation is designed to provide training in the following requirement of the directive: movement by each weapon to alternate firing position area.)

(1) *Requirement.* Actions and orders of platoon leader.

(2) *Solution.* Platoon leader should order all guns to displace to previously selected alternate positions vicinity Point C (see fig. 68). Guns are again placed in action and fire adjusted on the last target. If the casualties are litter cases, the platoon leader should have the platoon sergeant notify the company command post and arrange for evacuation. The platoon leader should notify Captain Company D of the following:

(a) Location of new position.

(b) Casualties.

d. Third situation. Company B is involved in a fire fight in the wooded area on JOURNEY HILL. 3rd Platoon Company B, making an enveloping maneuver around the northern part of the hill, receives direct fire from enemy self-propelled mount at Point 5. Captain Company B requests direct fire on the self-propelled mount and the battalion commander assigns the mission to the gun platoon. This

situation is given to the platoon leader by an umpire and the target is pointed out to him.

(NOTE: The above situation is designed to provide training in the following requirement of the directive: engagement of a target of opportunity.)

(1) *Requirement.* Actions and orders of platoon leader.

(2) *Solution.* The platoon leader should order two squads to concentrate their fire on Point 5. He should order the remaining squad out of action and alert it to make a hasty displacement to a supplementary position. He should then make an immediate reconnaissance with the squad leader and assistant gunner to select a firing position from which the self-propelled mount can be engaged. The platoon sergeant should take charge at Point D and order the alerted squad to displace to that position and engage the self-propelled mount. The platoon leader should remain in the vicinity of Point D, watching for movement by the self-propelled mount and for the appearance of any additional targets. The squad leader should send the assistant gunner back to lead the squad up to Point D. Only one gun should be brought forward.

e. Fourth Situation. The chief umpire informs the platoon leader that the enemy self-propelled mount has withdrawn to the east and that Company B has been successful in its attack on JOURNEY HILL. The gun platoon is ordered to displace forward and continue in direct support of Company B.

(NOTE: The above situation is designed to provide training in the following requirement of the directive: displacement by elements of the platoon to assist the advance of the attacking echelon.)

(1) *Requirement.* Actions and orders of platoon leader.

(2) *Solution.* The platoon leader with the leader of the squad at Point D should move forward to make a

hasty reconnaissance of JOURNEY HILL and vicinity to select firing positions. Before starting out the platoon leader should point out to his messenger a point where he will meet the other squad leaders and have the messenger return to Point C to bring them forward to the 1/4-ton truck. The messenger should also be given instructions for the platoon sergeant to have the platoon (less the squad at Point D) displace forward on foot to the vicinity of Point E. Here the squad leaders should meet their squads, orient them to the situation and lead them into the firing positions. The squad should be left in position at Point D until the other squads are in position, after which it will displace to the vicinity of Point I. When the occupation is completed the platoon leader should send the messenger back again in the ¼-ton truck to guide the platoon sergeant and the weapon carriers forward to the vicinity of Point E. The squad that was in position at Point D should replenish its basic hand load at this time. The platoon leader notifies Commanding Officer Company D of new positions.

f. Fifth situation. The chief umpire gives the platoon leader the following information: "The 1st Battalion, with Company B on JOURNEY HILL and Company A deployed along the edge of the woods NW of the hill, is about to continue the attack when orders are received from regimental headquarters to delay the attack and hold the present line; air reconnaissance reports heavy troop concentrations and armor forming to the front; Company M is ordered to remain in support of Company A and the gun platoon is ordered to provide antitank defense for Company B. Control flag indicates that enemy artillery fire is falling on JOURNEY HILL."

(NOTE: The purpose of the above situation is to halt the forward advance of the troops in the exercise.)

(1) *Requirement.* Actions of leaders and disposition of the platoon to meet the threatened attack.

(2) *Solution.* The platoon leader should make a more thorough reconnaissance and formulate a fire plan. He should acquaint himself thoroughly with the plan of Company B and contact the Gun Platoon Leader Company M to arrange for coordination of fire. Sectors of responsibility should be assigned to each squad and the platoon leader should assign a principal direction of fire and a firing position to each gun. Squad leaders should place their guns in the selected positions and have their additional guns manhandled to the positions. The platoon leader should submit his fire plan to the battalion commander for approval.

g. Sixth situation. The chief umpire informs the platoon leader that there is a shortage of ammunition on position and on the weapon carriers.

(NOTE: The above situation is designed to provide training in the following requirement of the directive: resupply of ammunition. The platoon sergeant will not be required to physically undertake the steps described in the solution. He will, instead, be required to give an account of his probable actions to an umpire.)

(1) *Requirement.* Actions of platoon leader and platoon sergeant.

(2) *Solution.* The platoon leader sends a written message to the platoon sergeant ordering him to replenish the basic load so as to have 120 rounds on position and 90 rounds on weapon carriers. The platoon sergeant should take the weapon carriers back to the battalion ammunition supply point and notify the battalion ammunition officer of his ammunition requirements. When the ammunition is loaded on the trucks he should bring the weapon carriers back to Point E, where the necessary amount of ammunition should be dumped and manhandled to the gun positions by the ammunition bearers. The platoon sergeant should contact the platoon leader for any additional orders.

6. CONTROL. *a. Disposition of umpires.* The chief umpire will be with the platoon leader controlling the exercise. One assistant umpire will be with each squad

and the platoon sergeant. The chief umpire will give the initial situation to the platoon leader at Point Z.

b. Enemy representations. Five target frames (type E targets) will be located on KELLEY HILL. One special target will be located at Point 5.

c. Signals. (1) The emergency signal to stop the exercise will be a series of short blasts on a whistle. The signal to resume the exercise will be one long blast on a whistle.

(2) Control will be by SCR 536 Radio.

(3) One radio will be with the chief umpire, whose call sign will be ABLE. Each assistant umpire will have a radio. The call sign for the umpire with the 1st Squad will be ABLE 1; 2nd Squad, ABLE 2; 3rd Squad, ABLE 3; Platoon Sergeant, ABLE 4.

(4) Safety officers and road guards will each have a SCR 536 (they will be on a different frequency than those used by the umpires). The call sign of the senior safety officer will be BAKER. The call sign for the safety officer with the 1st Squad will be BAKER 1; 2nd Squad, BAKER 2; 3rd Squad, BAKER 3; Road Guard, BAKER 4.

(5) Additional radios and batteries will be brought to the exercise area by the chief umpire.

d. Troop orientation. Prior to the beginning of the exercise, participating troops will be assembled and oriented by a designated officer. The following phases of the exercise will be covered.

(1) *Purpose.* The purpose of this exercise is to develop teamwork while in support of a daylight attack simulating combat conditions.

(2) *General situation.* The bridgehead, established last night on the east side of the CHATTAHOOCHEE RIVER, is not considered secure until the enemy is denied the use of CUSSETA ROAD for troop movements. The enemy seems to be organized principally as a strong point covering FIRST DIVISION ROAD. The 1st Battalion will pass through the 3rd Battalion and continue an attack that was stopped at daylight this morning. The

gun platoon is now in an assembly area awaiting orders to go into action in support of the battalion attack. The platoon leader has gone forward to receive the attack order.

(3) *Identification.* All umpires and safety officers will wear white shoulder loops and steel helmets with a horizontal white stripe. There will be no enemy personnel. Other personnel such as road guards will have no distinctive marking.

(4) *Safety rules.* All guns are to remain clear until they are in firing positions and the order to load is given by a safety officer. *No gun will be fired until authorized by a safety officer.* All guns will be cleared immediately if an emergency signal is given. All injuries will be reported to a safety officer immediately.

7. CRITIQUE. *a. Critique plans.* (1) The chief umpire will hold a critique in the vicinity of Point C at 0915, based on a consolidation of umpire check lists. He will assemble all participating personnel and comment on the following:

(a) Selection of firing positions.
(b) Actions of platoon sergeant.
(c) Actions and orders of squad leaders.
(d) Movement into position.
(e) Actions of squads going into action.
(f) Actions of all personnel in complying with orders.

(2) The Chief Umpire will hold a final critique in the vicinity of Point I at 1030, based on a consolidation of umpire check lists. He will assemble all participating personnel and comment on the following:

(a) Review of purpose and situation.
(b) Reconnaissance, plans, actions and orders of platoon and squad leaders.
(c) Effectiveness of engaging assigned targets.
(d) Conduct of displacement to alternate positions.
(e) Conduct and effectiveness of engaging targets of opportunity.

(f) Conduct of displacement to assist the advance of the attacking echelon.

(g) Effectiveness of reorganization for defense.

(h) Actions of platoon sergeant in handling weapon carriers and resupply of ammunition.

(i) Correct solution to errors made.

(j) The score made by the platoon.

(k) State whether purpose of exercise was accomplished by the participating unit.

(l) Answer any questions.

b. Scoring.

SUBJECT	VALUE	PLATOON SCORE
Reconnaissance	15	
Selection of positions	10	
Plan of action	15	
Initial orders	15	
Movement to alternate positions	10	
Displacement to continue support of the attack	15	
Resupply	10	
Target score: ½ per target hit—possible	10	
TOTAL	100	

8. TIME BREAKDOWN.

a. 0800 to 0815 Orientation at Point A to include:

(1) Purpose.

(2) General situation.

(3) Identification.

(4) Safety rules.

b. 0815 to 0900 Occupation phase—first situation.

c. 0900 to 0915 Engagement of assigned targets—second situation.

d. 0915 to 0930 First critique at Point C.

e. 0930 to 1030 Displacement phase to include:

(1) Third situation.

(2) Fourth situation.

(3) Fifth situation.

(4) Sixth situation.

f. 1030 to 1100 Final critique at Point I.

9. ADMINISTRATIVE DETAILS. *a. General.* (1) *Terrain reservations.*

(2) *Safety precautions.* The safety officer will be responsible for:

(a) Enforcing all safety regulations and rules.

(b) Familiarizing assistant safety officers and road guard with duties, safety regulations, and location of aid man. The senior safety officer will be with the chief umpire. One assistant safety officer will be with each squad. The senior safety officer will post the road guard at Point H at 0745 on the day of the exercise and tell him his specific duties, which will be to allow no one other than participating personnel to enter the exercise area until he is relieved. (Road guards at other entrances to the exercise area will be posted by the range officer on the date of the firing exercise.)

(c) Posting the aid men and ambulance properly, and issuing instructions concerning accidents. An ambulance will be at Point H and an aid man will report to the senior safety officer for instructions. In the event of an accident requiring evacuation of injured personnel, the road guard will be contacted by radio and instructed to have the ambulance report to the desired point. Serious casualties will be evacuated via FIRST DIVISION ROAD to the Station Hospital (Tel. No. 2344). Minor casualties will be evacuated to Dispensary A (Tel. No. 2252).

(d) Coordinating with range officer to insure road closures east of IVY ROAD and FIRST DIVISION ROAD. The safety officer will check with the range guard to assure maintenance of all road blocks and danger signs.

(3) *Material.* (See Administrative Form.)

b. Personnel. The following personnel, transportation and equipment have been requested through the Battalion (Regimental) S-3 and authorized by the Battalion (Regimental) Commander.

(1) *Participating unit and practice unit.*

(a) The Gun Platoon Company D will report to the chief umpire at Point A at 0745 on 1 May 1946. (Organic transportation will report to Headquarters Company D at 0715 to transport the unit to the area and return.) Uniform and equipment: class C, steel helmets, light packs, belts, filled canteens, and platoon equipment.

(b) The Gun Platoon Company H will be the practice unit and will report to the chief umpire at Point A at 0745 on 29 April 1946. (Organic transportation will be utilized.) Uniform and equipment: Same as participating unit.

(2) *Umpires.* Four assistant umpires will report to the chief umpire at Headquarters Company D at 0745 on 27 April 1946 and at 0710 on 29 April and 1 May 1946. (One 1½-ton truck will report to Headquarters Company D to transport the umpires to the area and return.) Uniform and identification: class C, steel helmets (with horizontal white stripe), and white shoulder loops. Equipment: one SCR 536 radio and one pair of field glasses for each officer.

(3) *Enemy representation.* There will be no enemy personnel; representation will be by targets.

(4) *Work detail.* One noncommissioned officer and six privates will report to the chief umpire at Headquarters Company D at 0745 on 27 April 1946. (One 1½-ton truck will be at Headquarters Company D to transport the detail and equipment.) Targets and tools for setting them up will be drawn by 1st Battalion S-4.

(5) *Safety officers.* Four officers detailed as safety officers will report to the chief umpire at Headquarters Company D at 0745 on 27 April and at 0710 on 29 April and 1 May 1946. Uniform and identification: same as the umpires. Equipment: one SCR 536 radio for each officer. The safety officers will ride to the area and return with the umpires.

(6) *Road guard.* One enlisted man detailed as a road guard will report to the chief umpire at Headquarters Company D at 0710 on 1 May 1946. Uniform: class C with steel helmet. He will ride to the area and return with the umpires.

(7) *Medical Detail.* One aid man and one ambulance will report to the chief umpire at Headquarters Company D at 0710 on 1 May 1946. The aid man is to be equipped with a Field Medical Kit and the ambulance with two litters and four blankets.

(8) *Miscellaneous.* Ammunition will be drawn by Company D from the regimental ammunition supply point on the afternoon of 30 April 1946. One 2½-ton truck will report to Headquarters Company D at 1300 on 30 April 1946 to transport ammunition in excess of basic load. The truck will remain with the gun platoon until the completion of the exercise. The basic load will be transported on the organic vehicles of the platoon.

(NOTE: No ammunition will be fired during the practice exercises.)

UMPIRE'S CHECK LIST

The following list will comprise the basis for umpire grading.

1. *Reconnaissance of terrain*: *a. Platoon leader.* (1) Was terrain evaluation thorough?

(2) Did he plan his reconnaissance?

(3) Was a maximum of terrain covered in a minimum of time?

(4) Did he exercise care to conceal himself from likely enemy observation during reconnaissance?

(5) Were squad leaders oriented to terrain properly?

b. Squad Leaders. (1) Were observation posts, position areas, and sectors of fire checked?

(2) Were alternate positions checked?

(3) Were routes of supply reconnoitered?

2. *Selection of positions*: *a.* Were positions properly spaced?

b. Was mask clearance adequate?

c. Was communication satisfactory between positions and observation posts?

d. Was back blast concealed from the front?

e. Did positions allow coverage of entire battalion front?

f. Did positions allow coverage of terrain adjacent to the battalion front?

g. Were routes of supply adequate and concealed?

3. *Plan of action*: *a.* Did selected observation posts, positions and fire plan accomplish the mission?

b. Was organization and control satisfactory?

c. Were communications effective?

d. Was plan tactically sound and suitable to the terrain?

e. Was plan flexible?

f. Did plan allow for support against armored vehicles?

g. Was displacement considered in plan?

4. *Initial orders*: Were orders complete, clear, brief and concise?

5. *Engagement of targets*: *a.* Was fire effective?

b. Were crews well trained in individual duties and team work while guns were in action?

6. *Movement to alternate positions*: *a.* Was movement orderly and timely?

b. Was speed, dispersion, use of cover and control exercised?

c. Was fire resumed quickly and accurately?

7. *Displacement*: *a.* Was displacement planned, controlled and orderly?

b. Was displacement timely and effected without unnecessary delay?

c. Was full utilization of available cover made?

d. Did platoon leader orient himself properly to new situations?

e. Was reconnaissance thorough and timely?

f. Were leaders prepared to issue orders upon arrival of the displacing squad?

g. Were weapon carriers moved as close to new positions as available defilade and concealment permitted?

8. *Resupply*: Were orders for resupply complete, clear and accurate?

CHAPTER 13

Squad Management

Although Tables of Organization change with times, squads always remain the basic element of a fighting unit. The individual soldier rarely accomplishes anything alone, but as a member of a team, he becomes a powerful force. As teamwork is essential to produce the final punch that leads to victory, the individuals of the team must be blended together to become a powerful force.

The squad in the Army, however, is not like the high school or college football and basketball team. It may be essentially the same in numbers but the similarity ends at this point. Athletic teams in high schools and colleges are composed of students on the same educational level. But the squad may include men with various degrees of intellect and from all stations of life. Therefore, the squad leader has before him the tremendous task of integrating a group of individuals who have few common interests and producing one enthusiastic, forceful unit.

As the leader of such a group, we normally have a staff sergeant in the Infantry. However, some types of squads may be led by sergeants or corporals. Prior to the formation of the twelve man squad with the staff sergeant as leader, the Infantry squad was composed of eight men, led by a corporal. Although the rank of corporal seems to have fallen into disuse in the past few years, this title is still the basic noncommissioned grade.

The word corporal as used in the Army refers to the lowest ranking noncommissioned officer. It is not, however, a title thought up by the United States Army for want of something better but is derived from the armies of the past. One source of information relates the title to the year 1650

when John Churchill, Duke of Marlborough, was known as Corporal John. History also shows that Napoleon was known as "The Little Corporal" and "Corporal Violet". In the Army of the United States there are many general officers who, at one time or another, wore corporal's stripes.

The next higher grade is sergeant. Regardless of the prefix before the title, which denotes increased responsibilities and pay, a sergeant of any grade is called a sergeant. This term, too, has an interesting background. During the days of Knighthood the rank applied to squires or gentlemen in attendance to princes or noblemen. It was also used in households for various individuals such as sergeant-surgeons, sergeant-at-law, etc. Even today, some of these titles are still used. For instance, Congress and various other organizations use the title sergeant-at-arms. In addition, many civil organizations such as police departments use the rank of sergeant for promotion purposes.

A soldier is promoted after careful selection and observation by his superiors because he has developed some or all of the qualifications desired. Generally, every soldier has some inherent characteristics which will be beneficial to him in attaining such a promotion. However, the quality of leadership is not inherent to the majority of men; rather, it is acquired through hard work and diligent study. Leadership is a combination of many characteristics which places one soldier above another in the eyes of a group; to develop ability to lead, a soldier must know what these qualities are and strive to attain them.

This article is not written for the purpose of telling officers how to handle noncommissioned officers but rather to clarify the relationship betwen them and to elaborate on the various responsibilities resting upon the shoulders of the noncommissioned officer. Also to assist the noncommissioned officer in the discharge of his duties and responsibilities as a squad leader. Regardless of the Table of Organization and Equipment of a squad the responsibilities remain the same. No squad leader can evade his responsibilities in any way without a detrimental effect upon the men under his leadership. The basic plan for distribution

of these responsibilities is set forth in Army Regulations 245-5.

This particular regulation should be a reference to all unit commanders and platoon leaders. Its interpretation may vary slightly with various officers but its basic principles cannot be misunderstood. For instance Change 1, par 3 (b) sets forth in nine subparagraphs a program for promoting selected personnel; explains how the value of a promotion will be enhanced by an explanation of the advantages and the prestige of the noncommissioned grades; and states that promotion of individuals will be publicized in news releases in order to increase the harmonious relationship between enlisted men, officers, and the public. Also, paragraph 4 lists a few of the responsibilities of the squad leader. Army Regulation 615-5, Appointment and Reduction of Noncommissioned Officers and Privates First Class is another source of material beneficial to company commanders and platoon leaders. It should also be brought to the attention of all noncommissioned officers since it is published for their benefit and guidance.

Other references used in this article are derived from SOP's used by various divisions and notes obtained from talks with various officers who have spent their life in the service and commanded many men in garrison and in combat.

CHARACTERISTICS OF A LEADER

Agility, knowledge, understanding, fairness, and patience are five prerequisites of a good leader. Many commanders might add other characteristics to this list but none will deny that any leader must possess a visible amount of each of these basic qualities.

Agility pertains to the mind as well as the body. A squad leader who keeps his body agile and is habitually capable of speedy movement is physically prepared for any eventuality. He should be equal to, but preferably better, in all physical exercises than the best man in the squad. That, of course, means hard work over and beyond the normal daily routine. The squad leader should have an agile mind so that in time

of crisis he can make sound snap decisions. His mind must be alert at all times so that his squad is never placed at a disadvantage. In order to have agility of mind he must also have knowledge.

Knowledge of the army and its tools is increasingly important. Just as all things change with time, the army does likewise. Recalling the weapons the Infantry operated with in the early days of World War II, it is obvious that there was a tremendous innovation of new weapons in the latter phase. The Infantry today, with its great variation of weapons, is a highly technical arm. The squad leader must keep up with the times if he expects to teach his men modern warfare. Which, of course, means that he must study during his off-duty hours in order to keep his instructional knowledge on a current basis.

Understanding each soldier in a squad is a difficult task in itself. Each soldier must be considered as an individual as well as a part of the team. First, the squad leader should try to ascertain the background of each member of his squad. The following factors must be considered in determining background: environment, schooling, sports, practical work, age, earning ability, religion, and other pertinent information that will assist the squad leader in knowing each man. Understanding may be simply defined as mental discernment; mental comprehension; or the power of perception. The squad leader must also be somewhat of a psychologist. It is only through the study of each individual personality that the squad leader is able to understand the thoughts and actions of each soldier directly under him, and thereby be able to forestall any thoughts or actions which might be detrimental to the squad. When the squad leader has acquired a complete understanding of each of his men he then automatically acquires patience.

Patience is exercising unfaltering endurance and perseverance in any work or activity in pursuit of a desired end. The squad leader has need of this characteristic since he has under him men from all walks of life, with different

capabilities and educational backgrounds. There will be times when the squad leader will have the desire to walk off the training field in disgust because of the inability of someone to grasp his instructions. But having acquired the "Patience of Job" the squad leader will instead exert his maximum efforts to the instruction of the least adaptable soldier. Also, there will be the type of soldier who likes nothing better than to heckle and annoy the squad leader. This man must, of necessity, be handled differently. Patience again enters the picture and, in addition, some form of discipline must be used to make that soldier realize that he is not running the squad and to show the other members of the squad who actually leads them. Many times this type of soldier changes his attitude when it becomes apparent that the squad leader is also the actual leader of the unit.

Fairness, as a quality, will assist a squad leader in the elimination of any ill-feeling between the men and himself. No matter how hard a leader may be, men will always respect him as long as they know that he is fair. A squad leader must distribute all duties within the squad equitably. When the squad is required to police and maintain a section of the company area the squad leader must assign certain of his soldiers to specific tasks for a definite period of time. At the end of the period he must rotate the tasks so that each man takes his turn and thus insure that each man does a fair share of the work. Favoritism is one thing that can cause much dissension in any type of organization. Since some men will have more money to spend than others, the ones with the money may try to curry favor with the squad leader by purchasing steaks and drinks or taking him to the show. The soldier spending his money in this manner naturally expects to be favored by the squad leader. The Army has many names for such activities, the most descriptive of which is "brown-nosing." The squad leader can avoid this situation but it is better to straighten out the offender with an explanation that such actions will not gain him any special grants or favors. A soldier thus enlightened becomes a better soldier and the other men develop

greater respect for the squad leader. Of course, if an individual persists, some form of discipline must be applied.

A squad leader does have a means of discipline. Although he does not have the power of his company commander under the 104th Article of War, he can admonish a man; he can reprimand a man; or he can recommend that man for extra details to his superiors. In addition, he can submit the case to his superiors for disciplinary action or he may prefer charges through the company commander. Although he must at all times maintain the necessary discipline in his squad to attain the maximum efficiency, he must not be overbearing. It remains then for the squad leader to use his powers of discipline judiciously. It is imperative that the squad leader does not exceed his authority nor on the other hand allow any soldier to take advantage of his good nature. The squad leader who exercises his disciplinary powers equitably gains stature and respect which creates the desired *"esprit"* within the unit.

"Esprit" is that feeling of unity that makes the squad the best in the platoon, the best in the company, the best in the whole Army. There are many reasons for a squad acquiring this desired feeling but in the final analysis it is the squad leader, who, through his leadership instills the desired competitive spirit which is indispensable to teamwork. In order to acquire this ideal, the squad leader must instill into his squad the desire to make the most soldierly appearance; be physically fit; have the best, cleanest, and neatest equipment; keep the best and neatest squad room, tent or hutment; and be the best trained soldiers in the outfit.

He will achieve this end only by constantly setting an example for his men to follow; by living the part of the ideal soldier; by showing them the proper way of using and cleaning equipment; by constantly impressing upon his men that their actions, their appearance, their very thoughts have a direct bearing upon each and every member of the squad and the squad as a whole.

RESPONSIBILITIES OF LEADERSHIP

In addition to the responsibilities already mentioned, the squad leader is also responsible for the physical appearance and physical condition of his men, safeguarding their deposit books and other personal property, enforcement of orders and regulations, preventing malingering or "gold bricking," and developing loyalty to his superiors. This seems like a tremendous load for a squad leader to carry—it is. However, a soldier is not promoted to the grade of staff sergeant just to enrich his pocketbook. Rather, he is paid additional compensation because he is considered the soldier "big enough" to do the job.

Physical appearance means more than just taking a shave every morning. It means wearing a clean, well-pressed and properly fitted uniform, a pair of highly polished shoes, and clean underwear and socks. The brass must be polished and the proper insignia should be sewed on the sleeve or other places as authorized. The hair must be well-trimmed and combed at all times. As it is doubtful if all soldiers will voluntarily adhere to this standard of neatness, the squad leader must assure himself of each mans appearance by personal inspection. The squad leader will inspect his men before falling out for reveille in order to be sure that each man is dressed properly and is wearing the proper equipment. He should check K.P.'s before they report to the kitchen for cleanliness of uniform and condition of fingernails. He will be sure that each man has washed and combed his hair before entering the mess hall for meals. Sometime during the day, the squad leader will inspect some of the clothing and equipment of his men.

Inspections of this type are necessarily continuous. During these spot checks he will look for rips, tears, and lack of buttons on clothing, thin soles on shoes, proper marking on all clothing and equipment as laid down in AR 850-150, rust on bayonets and rifles, open or damaged first-aid packets, damaged helmet or liner, clean mess gear, and clean, polished shoes. Upon finding any discrepancies he must make the soldier responsible for immediate correction.

He must insist that his men repair small rips and tears and replace buttons, utilizing "housewives" or sewing kits issued for that purpose. He must explain to his men the necessity for shoe rotation and the need for repairing shoes before the soles are worn through and beyond repair. It is the duty of the squad leader to have his men turn in to the supply sergeant all clothing and equipment in need of major repair work or worn out through fair wear and tear. He should be present at the issue and fitting of new clothing to be sure that each man receives his correct size or, if minor adjustments are necessary, to see that they are made promptly. It is by this method of inspection and supervision that he makes his men conscious of their appearance and insures that they are presentable at all times. In addition, the soldier takes more pride in himself when his clothes fit him properly and makes an additional effort to keep them neat and clean.

The situation will be somewhat different while in the field due to the lack of certain facilities. But men who are indoctrinated with a sense of cleanliness will put forth a great effort to maintain a high standard even under adverse conditions. Needless to say, there will always be the soldier who will gripe because of the lack of many facilities. This is the time for the squad leader to step forward and show his knowledge of field expedients and thus reap added respect from his men.

The squad leader must be certain that his men have sufficient rations and water. He must maintain water discipline within his squad and must also make certain that water from a questionable source is properly chlorinated or that Halazone tablets are used and have had time to react before the water is consumed. He must check each man for sufficient "C", "D", "K" or whatever ration is used and determine that no man eats before authorized to do so. He will also demonstrate to his men ways of heating and cooking these various rations to make them more palatable.

Physical well-being of the squad members is a further responsibility of the squad leader. This is a big problem, but it can be met and solved. If the squad leader knows

and understands his men the problem is simplified because he has first-hand knowledge of which individuals tend to be careless and slipshod. He should check the feet of his men for corns, callouses, ingrown toenails, improperly cut toenails, athletes foot or any other growths or skin-breaks. Only the medics can remedy some of these ailments but the squad leader can show his men the proper way to cut toenails and show them how to use hypo solutions to prevent athletes foot.

With healthy feet, the squad leader has men who can participate in sports as well as hikes. He should create enthusiasm for sports so that each man and every man will have a desire to participate. He might even create a competitive spirit within his squad, with each man vieing with the other to become the best in his particular field. In this manner the squad leader can offset some mental and physical illnesses; men that are too busy to think of themselves do not as a general rule become mentally ill.

Normally, men who are sick are anxious to go to the dispensary for a diagnosis and to be cured. However, some men believe they can cure themselves and others dislike going on sick call because of the "line-up and wait" angle. These men must be convinced by the squad leader that sick call is for them. Why? A number of reasons. First, because their name on the sick book protects them should there be a recurrence at some future date whether in the army or as a civilian. It may mean the difference between disability compensation or nothing. (See Army Regulation 345-415.) Also, since neither the squad leader nor the soldier can properly diagnose the ailment, they do not know but what the illness may be a communicable disease. Obviously, a soldier with a communicable disease is dangerous because he may spread the illness to the entire squad and a sick squad is of no value to its platoon, to its company or to the Army. Therefore it behooves the squad leader to have the sick soldier's name entered in the Sick Report and the soldier physically present at the place and time specified.

In conjunction with the legitimately sick soldier there is the malingerer or the "goldbrick." Everyone knows that the malingerer is a detriment to the squad; nothing is added by that individual except his presence. Here again the squad leader because of the knowledge and understanding he has of each man, can in some way appeal to the "goldbrick's" sense of fairness. That type of soldier must be made to realize that he is not only an individual but also a member of a team and the operation of the team depends directly upon his actions as well as the actions of the other men. This is the type of man that may need a booster charge. One way might be through slaps on the backs and compliments for encouragement. Another may be by administering severe reprimands and punishment. The type of stimulus used depends on the judgment and skill exercised by the squad leader.

Responsibilities of the squad leader are many and varied. Consider the soldier deposit. The government has organized this function for the benefit of enlisted men so that a soldier who deposits money with the government receives 4% interest after the first six months. The squad leader should explain to his men that the government pays very high interest on savings, that money deposited can be withdrawn when necessary upon approval by the regimental commander, the minimum deposit is $5.00 (five dollars) per month which may be deducted on the payroll or paid in cash, and that each soldier carries his own deposit book. Along with this instruction, he should instill into his men the desire to save money rather than to spend it promiscuously on liquor, women, and dice.

As drinking to an excess is an obvious evil, the squad leader should point out an example to his men. He will instruct his men that it is a violation of garrison regulations to bring liquor into the tent, hutment, or barracks.

Although gambling is a foolhardy pastime, men will continue to do it because they fail to realize that percentages are usually against them. Gambling was a means of recreation in many places during the war because of the lack of other recreational facilities, but in garrison many other

forms of recreation can be substituted for this vice. Above all, a squad leader must remember that *a noncommissioned officer will not gamble with privates or privates first class.*

Visiting a prostitute is a foolish way of throwing away money and contracting a disease. However, if men must have contact with that type of woman they must take precautionary measures. The squad leader must advise his men from time to time about the location of prophylactic stations and the necessity for taking prophylactic measures. It is better solution, however, to appeal to a man's moral sense. If this should fail, remember that plenty of exercise will temporarily curb the biological urge.

There is this to remember—the squad leader is the man who sets the example. He must set an example in conduct, appearance, fitness, and language. The squad leader has one of the hardest jobs in the army. He not only trains and disciplines his men but he eats with them and sleeps with them. There is no comparison between a squad leader's job and any civilian occupation.

The squad leader may have an assistant as in the rifle squad. It is up to the leader to use this assistant to the best advantage. One way would be to have him maintain a duty roster of the duties within the squad. Also to have him maintain a progress chart on each man so that the squad leader knows which men are deficient in a particular subject and need additional instruction. The assistant squad leader must know the policies of the leader so that he can take over in case of emergency. It is expected that the assistant squad leader will be the next leader of the squad and should therefore prepare himself for that job by study and work.

With all due respect to the brain of the squad leader and assistant squad leader, it is impractical to expect them to remember everything through their sense of hearing and seeing. Since it seems inevitable that men will make errors, some system must be devised to assist the memory. What better or simpler method is there than requiring each noncommissioned officer to carry with him at all times a notebook and pencil? These two simple expedients will save the

noncommissioned officer many a headache. For instance, Private Jones gets the job of sweeping out the tent, hutment, or squad area in the barracks and performs the task without criticism. However, the squad leader may select Private Jones to perform the same task the following day. Private Jones will naturally object on the grounds that he did the job yesterday and why shouldn't Williams do it today. If a roster had been maintained rather than depending upon memory, the error would not have been made. Although it is expected that noncommissioned officers will have a good memory and a retentive mind, it is impractical to expect them to remember everything.

Officers and men reading this article may think that a very heavy burden has been placed on the shoulders of the squad leader. Remember this—*these many responsibilities belong to the company commander. He cannot evade them but he may delegate them;* however, he alone must answer to the battalion or regimental commander. But no one man is expected to supervise each individual every minute of the day. Therefore, the subordinate grades were set up for the purpose of providing capable assistants to unit commanders. Consequently, the company commander must depend on his noncommissioned officers to follow his instructions, carry out his policies and assist in training the individual soldier.

It is impossible to get away from the fact that the noncommissioned officer is the backbone of any army; this has been proved time and time again. Where millions of men are involved, no commander can function without the assistance of corporals and sergeants. In the final analysis, it is the noncommissioned officer who determines whether the policies and orders prescribed by higher headquarters are actually put into effect.

CHAPTER 14

Extension Course of The Infantry School

Any future war in which this country may be involved will be fought by an essentially civilian army as have our wars in the past.

The army school system, recently revised, provides for resident instruction at various stages in the career of every regular army officer which is intended to insure that he receives, at the proper time, the military instruction which will bring and keep his efficiency up to the highest possible point. These schools in addition will provide instruction for a percentage of officers of the National Guard and Reserve. It will be impracticable, however, for the vast majority of the commissioned personnel of the two principal civilian components to actually attend these schools.

The army extension courses will be the principal source of military training for this majority and are designed to provide, primarily for them, a non-resident course of military instruction. The extension courses will, of course, be available also to members of the Regular Army and to certain specially selected civilians.

The primary purpose of this article is to furnish to infantrymen pertinent information about the new army extension courses. It will discuss certain War Department policies, with particular reference to changes in the extension course system; the general structure of the courses and some of the ideas behind that structure; problems of the school in connection with the preparation and plans for administration of the courses and the motives behind some of the solutions adopted; steps taken to insure that teaching is correct and up to date; and checks and balances to insure fairness and maximum benefit to the student.

The most radical change in the War Department policy governing the new extension courses is the decision to decentralize preparation and administration, except of Command and Staff College courses, to the service schools. Those familiar with the former extension courses, operation of which ceased about four years ago, will remember that they were administered by corps areas (corresponding to the more recent service commands) and that distribution and grading of lessons was accomplished principally by unit instructors of the National Guard and Reserve in the field. Thus distributed, the labor involved, while considerable, constituted no major burden upon any particular agency.

All of this work is now to be done by the various schools and other agencies specifically charged with the duty. This will, of course, throw a tremendous additional burden upon the schools, particularly those of the larger branches, such as the Infantry. The War Department decided that this disadvantage, obvious and serious as it was, was more than overbalanced by these advantages of the new system:

a. Insurance that instructional material would be prepared by those best qualified.

b. Simplification of revision, since any changes in doctrine or methods are almost invariably effected at the appropriate school, thereby insuring the earliest practicable revision of the extension courses to conform.

c. Greater uniformity and expertness in grading and the availability of expert opinion to decide any difficult questions that might arise in connection with the grading.

Another decision by the War Department was to limit the texts to be used in connection with extension courses to official War Department publications. This decision, of course, was subject to certain exceptions which in general are included under these two classifications:

a. Special texts are permitted for the presentation of new or changed doctrine caused by changes in organization or equipment and which have not yet been incorporated in official publications.

b. Special texts are also authorized to present certain instructional methods or academic devices used in the schools which, while tending to improve or facilitate instruction, are not of a nature suitable for inclusion in War Department manuals.

Insofar as practical the extension course instruction prepared at any school will parallel resident instruction. Most of the divergences are due to the impracticability of teaching certain types of subjects, such as rifle marksmanship, by extension course methods.

The general structure of the extension courses is similar to that of the old courses. They are divided into six numbered series, each of which is intended to provide for officers of a given grade the instruction necessary to fit him to perform his wartime duties in that grade and also to fit him for promotion. The series and the grades to which they apply are as follows:

10 series - Precommission instruction
20 series - 2d Lieutenants
30 series - 1st Lieutenants
40 series - Captains
50 series - Majors
60 series - Lieutenant Colonels

In furtherance of the objective of insuring the most expert preparation possible for all instructional material, the War Department has designated certain of the subcourses as common to all branches. These common subcourses have been assigned for preparation to the appropriate major forces, each of which in turn has assigned responsibility for their preparation to the agency under its command best qualified for the task. For example, the subcourses on administration were allotted for preparation to the Adjutant General's School; those on basic communication, to the Signal Corps School and that on mess management to the Quartermaster School.

Each branch school, of course, has been charged with responsibility for the preparation of all subcourses essentially for its own branch.

For higher instruction, the Command and Staff College at Ft. Leavenworth has been charged with the duty of preparing certain subcourses dealing with action of the combined arms and with the operations of a general staff. These will be integrated with the subcourses of the 50 and 60 series prepared by the branch schools and will be administered by the Command and Staff College.

All other subcourses including the common ones will be administered by the branch schools, even though some of these courses were prepared by other preparing agencies. This means that an officer taking the Infantry Extension Course will look to The Infantry School for all instructional material except those subcourses of the 50 and 60 series prepared by the Command and Staff College.

In line with the desire to make the extension courses as nearly as possible parallel with and a part of the regular instruction of the school, it was prescribed that extension course operation at The Infantry School be under supervision of the Assistant Commandant, who acts for the Commandant in planning and supervising resident instruction.

Directly under the Assistant Commandant in the extension course work is a Director of Extension Courses for the school.

When tentative information was received early in the fall of 1945 that extension course operations were to be resumed, the Assistant Commandant of The Infantry School made a thorough study of the extension course system and formulated plans based on available information from the Army Ground Forces.

With the approval of the Commandant, the Assistant Commandant prescribed certain additional policies to apply to the Infantry extension course. Most important of these policies was that of emphasizing certain matters which had been demonstrated to require additional emphasis by the operations of Infantry in World War II. Among these were the following:

a. The importance of leadership on the part of small unit commanders.

b. Maximum use of available fire power, with emphasis on that of individual weapons.

c. The importance of ingenuity and individual initiative —two qualities which were distinguishing characteristics of the American soldier during the war as contrasted with soldiers of the hostile armies.

d. The fundamental importance of teamwork in combat to include maximum use of supporting weapons and methods to make their assistance most effective.

e. The importance of night operations.

f. The importance of commanding terrain.

Another important decision made by the Assistant Commandant was that all instructional material should be actually prepared by members of the instructional sections, with the AEC Section primarily responsible only for the form of the material and its conformity with the best correspondence course technique.

The magnitude of the task of preparation was, of course, partly responsible for this decision. That task involved the preparation by The Infantry School of something like 450 lessons, each of which was estimated to require about 40 hours work by a single officer.

The primary reason for the decision, however, was the obvious presumption that members of the instructional sections were best qualified for the duty. They were already thoroughly imbued with their subjects and already had developed instructional methods designed to impart information to the students in the most effective manner.

Based on this decision a process was worked out for production of the subcourses to be prepared by the school, designed to insure the highest quality of instruction and the most complete safeguards to eliminate errors and insure fairness to the student.

This process started with the reference of a given subcourse to the chief of the appropriate instructional section. He was furnished the title of the subcourse, the number of lessons, the scope of the subcourse as approved by Army

Ground Forces and the total number of credits to be allowed for the course.

The section chief caused these data to be studied and analyzed with the following purposes in mind:

a. To determine the elements of instruction essential to a proper knowledge of the subject as a whole.

b. To eliminate any phase of instruction which could not be taught by extension course methods.

c. To arrange the essential elements of the instruction in logical sequence.

d. To divide these elements into phases suitable for presentation in a single lesson.

After completion of these preliminary arrangements the section chief caused the various phases to be assigned for preparation to those members of his section best qualified for the tasks.

Upon receipt of a directive to prepare one or more lessons of a subcourse, the officer charged with that duty decided upon the lesson's objective or objectives, and the important components of that objective to be emphasized in the lesson for best instructional results. After arranging these in logical sequence he prepared the lesson which was then returned to the section chief for approval.

The section chief was then required to have it "expert tested". This involved a painstaking review by another officer thoroughly familiar with the subject, to detect any errors in tactics or technique.

After any changes made necessary by this review had been effected, the lesson was ready for final preparation by the extension course section.

For this purpose an officer of the instructional section concerned was placed on special duty with the extension course section, usually for a period of about a month, to make the changes directed as a result of the review in the extension course section and to see that the subcourse as a whole maintained its continuity and instructional completeness after such changes were made.

Review in the extension course section was painstaking and exhaustive. Few lessons were returned for revision or correction less than twice and many were thus revised from 8 to 10 times.

While the primary responsibility of the extension course section, as stated, was to insure correct form and instructional technique, there was no hesitancy about raising questions of tactical or technical doctrine when such questions seemed pertinent. All reviews were made with the attitude that the school was responsible for the work and if a "bug" existed in a lesson, the job was to catch it regardless of responsibility.

When the lesson was finally approved in the extension course section, it was referred for a "non-expert test" to the chief of another than the preparing section. He was requested to have the lesson solved by an officer (or enlisted man) of approximately the grade and experience of the average student for whom the lesson was intended. This testing officer was provided with all texts and required to go through the same processes the student would have to go through in solving the lesson. He was required to make a record of the time consumed by him in reading the text and solving the requirements.

This test was designed to furnish a check upon the adequacy of the texts, the level of instruction, the clarity and validity of the requirements and the number of credits allotted to the lesson (in general, one credit per hour of work required).

If this non-expert test indicated the need for any important changes, the lesson was referred back to the original preparing officer who effected them. Before being prepared for submission to Army Ground Forces for approval, each lesson was again finally approved by the chief of the instructional section most concerned.

The general form in which the extension courses are prepared has changed but little from that prevailing before their discontinuance early in the recent war. At the end of this article appears a list of the extension courses of The

Infantry School arranged in the normal order in which the student will take them. Each of the subcourses listed is divided into a number of lessons, the average number being 8.

Each lesson is normally subdivided into a lesson assignment sheet, an answer sheet and a solution sheet, the last named being subdivided into these four parts: a solution, discussion, comments, and a cut sheet. The student will normally receive with his graded answer sheet the solution, its accompanying discussion and the comments upon which errors in his solution are graded. He does not receive the cut sheet which is for the information of the grading officer. (The student receives none of the above material for examination and review lessons.)

Some of the problems connected with the preparation of the component parts of a lesson as listed above are discussed in succeeding paragraphs.

The lesson assignment sheet informs the student of certain general facts in connection with the lesson, including the text assignment on which it is based and the lesson objective. Every effort is made to present each situation as clearly and concisely as possible and to make each requirement sufficiently definitive to insure that the student will get an exact picture of the information desired. In addition, requirements specify methods to be used in the student's presentation of the solution to insure that, if his solution is correct, it will be similar to that prepared by the school. For example, if the school puts its solution of a requirement on an overlay, the requirement will prescribe that the student do the same.

Requirements also are worded, where practicable, to require the student to apply information obtained from the text rather than to merely repeat it—or copy it from the text.

In the preparation of situations and requirements one fact is emphasized and reemphasized. That is, the fact that the student will have only the information furnished him in writing. That has led to a saying which has become almost

a slogan with those charged with the preparation of extension course material. It is, "If I have to ask a question, it's wrong." This of course is recognition of the obvious fact that the student in New Mexico, Montana or Ohio can ask no questions about the lesson he receives by mail and must solve in writing and return by mail.

Solutions prepared by the school are required to give categorical answers to the questions asked or solutions of the requirements presented. They include no explanation or discussion unless the student has been required to explain his answer or give the reasons for it.

Each solution is followed by a reference to the paragraph, or paragraphs, of the text upon which it is based.

The discussion, where used, is usually one of the most instructive parts of the solution. It is required that the discussion apply to the particular problem and that it not be a mere quotation from the manual. For example, in the discussion of a requirement for the location of the rifle platoons of a rifle company in a defensive position, it is considered poor practice to make a statement like this: "The rifle platoons should be located so that they are mutually supporting." Rather the statement would be something like this: "The right platoon, from its location on Hill X is able to support the left platoon by fire across its front, etc."

In addition to explaining how approved doctrine, tactical or technical, applies to the particular requirement under consideration, the discussion also gives the reasons why certain other probable solutions were not adopted.

The comments are made up from a careful analysis of the solution and the discussion. Each requirement is carefully analyzed and broken down into its various single component parts. Appropriate comments are prepared for each such single component to provide a full cut for omission or a partial cut for a minor error or incomplete solution.

Similarly, the discussion of each requirement is analyzed and comments prepared upon which to base cuts for the incorrect solutions discussed and for any other matters necessary to insure a full, fair and correct grading of the student's performance.

The primary motive in the great care with which comments are prepared is, of course, that of insuring absolute justice for the student. There is a secondary motive, however, of simplifying as much as possible the task of grading which, to borrow a Hollywood term, is going to be colossal.

Based upon Army Ground Forces estimates of enrollment, The Infantry School will be grading 1500 or more lessons per day when the operation of its extension course is in full swing. A majority of the lessons in The Infantry School course are of a type which cannot be graded by templet or similar time saving method. This, of course, is because they are tactical and involve so many possible decisions by the student that they cannot all be anticipated. If they could it probably wouldn't be wise to try to do so.

As a result of the magnitude of the grading task indicated above, every effort has been made to have the comments constitute as nearly a complete answer as possible to how a solution should be graded.

It has already been stated that comments are limited to a single component of the solution. In addition, comments of a general nature have been avoided. For example, a comment on the location of an ammunition supply point such as this would be incorrect: "Your ammunition supply point has no defilade and is too close to the front line." That should be divided into two comments. Likewise, this comment is not the type desired: "The support platoon is too close to the MLR." There is no way for the grading officer to know how close is too close, so it is required that this comment be extended by stating either "it should be no closer than 250 yards" or "it should not be forward of (such and such a line)."

Manifestly it will be impossible to anticipate all errors and provide for them by comments. Where errors occur that are not covered by the comments the grading officer, if the error is covered in the solution or discussion, will put an appropriate remark on the solution. If the apparent error is not covered in the solution or discussion it will be referred to the appropriate instructional section of the

school with a request for decision. This method is in line with the policy of placing responsibility for all tactical and technical instruction upon those who teach it at the school as a regular duty.

After the decision has been obtained an appropriate comment will be prepared for inclusion in the next revision of the lesson concerned.

In addition to the tremendous job involved in the mere grading of the papers, the grading officers will be charged with furnishing information on which to base revisions. The process of revision will be continuous. Revisions will be made necessary by changes in doctrine or methods as a result of changes in organization or equipment or as a result of other causes. They will also be made when the grading officers detect flaws in certain lessons or certain questions or requirements indicating that for one reason or another the percentage of failures on them is too high.

As each lesson is graded, the grading officer will extract from it certain data to be given to the chief of the grading group. He will maintain a running consolidation of these data and will report to the director when his record indicates that a certain lesson or certain requirements or questions in a lesson are causing an undue number of failures through lack of clarity or for any other reason. He will also indicate when any lesson or part of a lesson gives similar indications of being too simple.

To insure that revision, when necessary, is effected as quickly as posible certain members of the extension course section of the school will be charged with the continuing duty of detecting the need for revision and obtaining the necessary aid from the instructional sections to prepare it.

The coordinator of training of the school notifies the extension course section when any revision of an existing manual is authorized or when the preparation of any new manual is directed.

Upon receipt of notification of any contemplated change in a manual the preparation group of the extension course

section will check immediately to determine whether the proposed change will affect any part of any of the infantry subcourses.

If it will, immediate steps will be taken to obtain as quickly as possible the approved changes. If the revisions resulting are of a minor nature they will be made by means of errata sheets or changes to the lessons already published and will be incorporated in any uncompleted lessons. If the changes are major in their nature and affect lessons already prepared, work will be started on the preparation of a new lesson as soon as the plan has been approved by Army Ground Forces.

Information as to eligibility for enrollment and methods of enrollment is contained in AR 350-3000, 30 March 1946. It is likewise available at the headquarters of any Reserve or National Guard unit. For the benefit of those who may not have the information readily available, however, it is summarized below:

The following are eligible for enrollment in the Infantry Extension Course:

a. Any Infantry officer of any component.

b. Any officer of any other branch who has successfully completed the appropriate extension course series of his own branch school or is otherwise qualified.

c. Any warrant officer of any component may enroll in the 10 series or in any selected subcourse which might provide training to assist in the performance of his duties or prospective duties.

d. Any enlisted man of any branch of any component may enroll in the 10 series.

e. Certain civilians may enroll in the 10 series or in other series under certain prescribed conditions which it is not considered necessary to detail here.

Applications will be made on WDAGO Form 145 as follows:

Applications of members of regularly organized units of any component will be made through channels to the regimental or other corresponding immediate commander. They will be forwarded by him with action indicating approval or disapproval, direct to The Infantry School.

Reserve corps applicants not assigned to regularly organized units will forward applications direct to their Regular Army instructor who will forward them to The Infantry School.

ANNEX I

LIST OF APPROVED SUBCOURSES CONSTITUTING THE EXTENSION COURSE OF THE INFANTRY SCHOOL

Subcourse	*Title*
	10 SERIES
10-1	Organization of the Armed Forces, 8 lessons and an examination.
10-2	Leadership, Discipline, Courtesy and Customs of the Service, 4 lessons and an examination.
10-3	Drill and Physical Training, 5 lessons and an examination.
10-4	Map and Aerial Photograph Reading, 9 lessons and an examination.
10-5	Interior Guard Duty, 4 lessons and an examination.
10-6	Military Sanitation, 5 lessons and an examination.
10-7	First Aid, 5 lessons and an examination.
10-8	Security Against Chemical Attack, 5 lessons and an examination.
10-9	Camouflage and Concealment, 5 lessons and an examination.
10-10	Scouting and Patrolling-I, 6 lessons and an examination.
10-11	Combat Intelligence-I, 4 lessons and an examination.

10-12 Communications for all Arms and Services, 9 lessons and an examination.
10-13 Military Law—The Law of Military Offenses, 6 lessons and an examination.
10-14 Administration-I, 7 lessons and an examination.
10-15 Individual Weapons, 9 lessons and an examination.
10-16 Individual Clothing and Equipment, 4 lessons and an examination.
10-17 Estimate of the Situation and Combat Orders, 6 lessons and an examination.
10-18 Combat Formations, Squad and Platoon, 4 lessons and an examination.

20 SERIES

20-1 Map and Aerial Photograph Reading-II, 9 lessons and an examination.
20-2 Methods of Instruction, 6 lessons and an examination.
20-3 Military Law—Courts Martial, 9 lessons and an examination.
20-4 Crew Served Infantry Weapons Not Self-Propelled, 9 lessons and an examination.
20-5 Self-Propelled Weapons, 6 lessons and an examination.
20-6 Mines and Booby Traps, 5 lessons and an examination.
20-7 Hasty Field Fortifications, 6 lessons and a review.
20-8 Mess Management, 9 lessons and an examination.
20-9 Scouting and Patrolling-II, 9 lessons and an examination.
20-10 Combat Intelligence-II, 7 lessons and an examination.
20-11 Motor Vehicles; Operation and Maintenance, 7 lessons and an examination.
20-12 Troop Movement and Bivouac-I, 5 lessons and an examination.
20-13 Communication in the Infantry Company, 7 lessons and an examination.

20-14 Rifle Platoon and Supporting Weapons in Defensive Combat, 7 lessons and a review.
20-15 Rifle and Weapons Platoons Reinforced in Attack, 8 lessons and a review.
20-16 Heavy Weapons, Antitank and Cannon Company Platoons in the Attack, 8 lessons and a review.
20-17 Small Unit Infantry - Tank Team, 6 lessons and a review.
20-18 Combat Supply of Infantry Company, 6 lessons and an examination.
20-19 Air Navigation (for pilots only), 9 lessons and an examination.

30 SERIES

30-1 Administration-II, 9 lessons and an examination.
30-2 Training Management, 5 lessons and an examination.
30-3 Terrain Evaluation, 5 lessons and an examination.
30-4 Preparation of a Field Exercise, 5 lessons and an examination.
30-5 Estimate of the Situation and Combat Orders, 8 lessons and an examination.
30-6 Meterology for Light Aviation (for pilots only), 9 lessons and an examination.
30-7 Communications in the Infantry Battalion, 9 lessons and an examination.
30-8 Troop Movement and Bivouac-II, 7 lessons and an examination.
30-9 Reconnaissance and Security, 5 lessons and an examination.
30-10 Rifle Company in Defense, 7 lessons and a review.
30-11 Heavy Weapons, Antitank and Cannon Companies in Defense, 7 lessons and a review.
30-12 Rifle Company in Attack-I, 9 lessons and a review.
30-13 Rifle Company in Attack-II, 7 lessons and a review.
30-14 Heavy Weapons, Antitank and Cannon Companies in Attack, 7 lessons and a review.
30-15 Rifle Company Reinforced in Retrograde Movements, 4 lessons and a review.
30-16 Airborne Troops, 9 lessons and an examination.

30-17 Combat Supply of the Infantry Battalion, 6 lessons and an examination.

40 SERIES

40-1 Map and Aerial Photograph Reading-III, 7 lessons and an examination.
40-2 Rules of Land Warfare, 9 lessons and an examination.
40-3 Military Government, 9 lessons and an examination.
40-4 Employment of Light Aviation, 9 lessons and an examination.
40-5 Traffic Control, Reconnaissance and Planning, 9 lessons and an examination
40-6 Combat Intelligence, 9 lessons and an examination.
40-7 Troop Movement and Bivouac-III, 6 lessons and an examination.
40-8 Staff Functions, 9 lessons and an examination.
40-9 Counterfire Organization and Technique, 5 lessons and an examination.
40-10 Air-Ground Cooperation, 5 lessons and an examination.
40-11 Field Artillery and Chemical Troops in Support of Infantry, 6 lessons and an examination.
40-12 Employment of Tanks with Infantry, 7 lessons and a review.
40-13 Tactics and Techniques of Engineers, 5 lessons and an examination.
40-14 Infantry Battalion in Defense, 9 lessons and a review.
40-15 Infantry Battalion in Attack, 9 lessons and a review.
40-16 Communication in an Infantry Regiment, 9 lessons and an examination.
40-17 Combat Supply of an Infantry Regiment, 6 lessons and an examination.

50 SERIES

50-1 Terrain Evaluation, 5 lessons and an examination.
50-2 Infantry Battalion and Regiment in Defensive Combat, 7 lessons and a review.

50-3 Reinforced Infantry Battalion in Attack-I, 9 lessons and a review.

50-4 Reinforced Infantry Battalion in Attack-II, 9 lessons and a review.

50-5 Reinforced Infantry Battalion in Jungle and Mountain Operations, 8 lessons and a review.

50-6 Infantry Battalion in Retrograde Movements, 6 lessons and a review.

60 SERIES

60-1 Tactical Use of Motors, 9 lessons and a review.

60-2 Development and Security of an Infantry Regiment in Defensive Combat, 6 lessons and a review.

60-3 Infantry Regiment in Defense, 7 lessons and a review.

60-4 Infantry Regiment in Attack, 9 lessons and a review.

60-5 Reinforced Infantry Regiment in Offensive Combat, 6 lessons and a review.

CHAPTER 15

Combat S-4

"Mud, Mules and Mountains," a book of cartoons drawn by Bill Mauldin, fully describes the hardships that beset the doughboy during World War II. This same title might well be used for a book written about supply, especially supply in its relation to an infantry battalion.

The world today thinks of war in the terms of machines, production, fast moving cargo ships, airplanes and smooth operating motor vehicles. The picture as a whole is true and no one will deny that these modern inventions of men helped to win World War II. But often, far too often, the modern soldier was forced to fight as his forefathers had fought a hundred years before. He was forced to climb mountains, penetrate jungles and cross swamps, leaving his modern transportation behind. Wherever the doughboy went, his supplies, like Mary's little lamb, came tagging along behind him. But unlike his forefathers, who lived off the land they wrested from the enemy and carried most of their ammunition with them, the modern doughboy demanded more food and water, more luxuries, and his weapons required ammunition in enormous quantities.

As he steadily routed the enemy from their stronghold, he progressed farther and farther from his base of supply. Engineers who kept the roads open were seldom able to keep abreast of the front-line troops in mountains. In order to keep the war moving and the fighting men well supplied, supply, too, fell back a few years, and almost overnight, mule-pack trains and man-pack trains became the fashion.

It rained constantly, or so it seemed to everyone, and with each new rain the difficulties mounted. The valleys

were seas of mud and the mountain trails were wet and slippery. Men had to fight nature to exist and the enemy to keep moving. Long trains of mules and men wearily struggled up and down the mountains in the rain and dark until they became machines. Yesterday was forgotten, today was hell, and tomorrow was never given a thought.

The forward movement of supply in rear areas is a matter of loading supplies on trucks, then driving them forward to be unloaded. Battalion supply is seldom that simple. Often battalions fought miles from their own supply points as in the case of one battalion in Italy. The Bn S-4 used 2½-ton trucks to carry his supplies to a truckhead. Here they were transloaded to 1/4-ton trucks and moved farther up the mountain to a "jeephead." Again they were transloaded to mule-pack trains and carried even higher to a "mulehead." At this point men with pack boards took over and made the final leg of the journey. The men were forced to use a trail several miles long that was under enemy observation. The trail was constantly under enemy fire and the men moved along with an interval of 400 yards between them. To close up meant an artillery concentration. In spite of the difficulties and hardships, this battalion completed its mission with success. The spirit of those men who kept the necessary supplies moving forward to that battalion was the spirit portrayed by battalion supply personnel throughout the war. It was during World War II that this spirit helped an American Army cross the Vosges Mountains in winter (a maneuver previously considered impossible) and to speed to the Rhine, thus shortening the campaign by months. The troops, as they pushed deeper and deeper into the mountains, always had confidence that their supplies would reach them and, except in rare instances, they always did. Few meals were missed and hot food was often served high on top of mountains where it was least expected. Next to mail, hot food is the biggest morale booster for the doughboy. Mail is always his first thought, but when he has received the letters from home his thoughts then turn to hot food.

When it was impossible to get hot meals to the men, coffee and doughnuts or some kind of pastry went forward. This was as easy as sending K or C rations up because the pastry was packed in cardboard boxes and the coffee put into water cans.

FIGURE 69.—"It'll take a week to cut a motor trail out of this mule path."

The Bn S-4, in addition to keeping the battalion supplied with the regular classes of supply, is in a position to render hundreds of little services to the personnel of his battalion. He is constantly moving back and forth between his unit and the rear area. He should be constantly on the alert for things that might be used to build morale or make things easier for the men. There is the case of a battalion that was on a defensive mission in France. The weather was

very cold and snow covered the ground. The sector was active enough to require the men to be in their fighting holes for long periods. Behind the company, squad shelters were dug so the squads could be relieved and rest for a while. The roof was logs and earth was thrown on top to reinforce it. When fires were built in them the snow on top melted and soaked through the dirt, then dripped from the logs onto the men. Several things were tried but nothing would stop the leaking. One day the Bn CO told the S-4 to get some roofing. He was joking, of course, but the S-4 requested it in the rear anyway. He was told there was none available. Several weeks before when they were moving into the area he had seen some engineers building huts in a small town they were passing through. Taking his sergeant with him, the S-4 went back to see these engineers. When he returned he had enough commercial tar paper roofing for all the dugouts in his battalion. That roofing meant a lot to the men and, because the Bn S-4 was alert, they were able to have it.

Another time a battalion had been fighting for a considerable length of time and were unable to get showers and clean clothes. The bath unit was about ten miles to the rear and it was impossible to get the men there from the front without a lot of work and confusion. There was a small area behind the battalion that was never shelled and was in a protected place; a small stream running through the area would furnish plenty of water. He talked to his Bn CO about trying to get the shower unit moved up for a few days. His CO agreed so he went to work and had the shower moved up. He requested clean clothes from the regimental S-4 and received them. Then, as an added attraction, he set up a kitchen nearby. The battalion went through the shower a platoon at the time. As each platoon finished, they had coffee and doughnuts at the kitchen, then returned to their company so another platoon could go through. Morale jumped a hundred percent. The S-4 had lost a night's sleep while getting the shower unit set up, but the sleep was lost for a good cause.

Chewing tobacco was always scare, even though only a few men used it. The Red Cross representative always had a good supply but often when men wanted the tobacco the Red Cross man was busy elsewhere and the men were unable to carry a big supply with them. The Bn S-4 stepped in. He talked to the Red Cross repesentative and got a supply of tobacco from him to carry in his own jeep. Word soon made the rounds and when anyone needed more tobacco they would look up the S-4 and get it or send him word and he would send it to them. Not only was the morale of these men raised but their confidence in the supply system and their officers was increased.

A Bn S-4's duties are multiple and morale is not one of them, but due to the contacts he makes he often is in a position to help out in this department. Both officers and men in the line companies are inclined to look upon him as a rear echelon "Joe" who is never in any danger. The S-4 generally lives in the Bn CP and has to travel roads two and three times a day that are under constant shellfire, in addition to doing a lot of work throughout the battalion zone. When one is wounded the line companies generally think of it as an accident rather than the fact that he, too, is in the middle of things. By visiting the companies often when he has the time and doing things for the officers and men to help them, he will dispel this feeling and get their cooperation. The best Bn S-4's are generally officers who have served their time in a line company and thus know the problems the men are facing. The officer who leaves a line company to be a Bn S-4 with the feeling that he is getting a soft job is in for trouble. There is a lot of work, and often he has to do his job regardless of enemy fire or other adverse conditions. He attempts to locate his supply points in an area defiladed from enemy observation, but often this is impossible and his trucks always draw fire. This does not mean his job is more dangerous than a platoon leader's —it is not. His chances of getting through a war are far better but the job is no cinch. He must work long hours and sleep only after the supplies have gone forward. His first

job should be to prove to the battalion that he is there to help and cooperate, and that he is willing to share their danger to get the job done. He must be unselfish.

The Battalion Commander is responsible for the supply of his battalion. The Battalion S-4, as a member of the Battalion Staff, is his chief assistant in matters of supply. In Field Manual 7-20, the following duties are listed for the Battalion S-4:

1. Preparing the battalion supply plan based upon the regimental supply plan and the tactical plan of the battalion commander.

2. Controlling elements of the battalion trains (ammunition and kitchen and baggage trains) when they are operating under battalion control. He is assisted in this duty by the battalion transport officer.

3. Coordinating the regimental supply echelon with details relating to the movement of battalion supplies and trains.

4. Ascertaining the supply requirements of companies and attached units through personal contact.

5. Responsibility for establishing and operating the battalion ammunition distributing point.

6. Insuring, during combat, that an adequate supply of ammunition is delivered to companies and any attached units.

7. Making a reconnaissance for covered routes between the battalion and the regimental distributing points and points of release of trains, and regulating the movement of vehicles on these routes.

8. Keeping in close touch with the battalion command post in order to coordinate supply operations with the tactical situation, and the supply plans with the tactical plans of the battalion commander.

We can sum up all of these duties in a few words: *He must have the right kind of supplies in the right amount at the right place at the right time.*

The following story might help you to understand his job.

A battalion was fighting behind Cassino and all supplies had to be packed up to them by mule train. The trail led across muddy Purple Heart Valley and up a mountain trail to the battalion. Every step was a hell of mortar and shell-fire. The battalion S-4 with his men and mules had been

FIGURE 70.—"Sorry, fellows, but your replacements didn't come up."

making the eight hour trip up and back every night for over two weeks. Almost every night a man or a mule, and some nights both, failed to return. All of them were at the point of collapse from fatigue and weariness. One night the regiment received a few replacements and the regimental S-4 got permission from the CO to use them to replace the worn-out mule skinners who had been going with

this Battalion S-4 up the mountain every night. When the mule train came down the mountain that night, the major called the battalion S-4 and said, "Davis, we received some replacements tonight and I want you to tell your men that in the morning they are going back to the rear for three days rest where they can get hot showers and plenty of hot food. I would like for you to get some rest also, but I don't have anyone to replace you." Davis gave a tired smile and replied, "Those men have been doing a great job and they are worn out. This will be good news to them." Davis left, but in a moment he returned. "Major," he said, "I would like to ask you one more question." "Go ahead," replied the major. Davis gave another weary smile and said, "Major, what am I going to tell those poor damn mules?"

CHAPTER 16

An Equal and Opposite Reaction

Early in the past war combat reports from both sides of the world emphasized the necessity for some type of larger caliber weapon that could be carried by front-line troops. The primary need was for a gun which could accurately engage point targets with a high explosive projectile. No existing weapon could adequately perform the missions of this type except at short ranges, especially in difficult terrain. Indirect artillery fire was not sufficiently accurate to insure hits on very small targets. In many cases, weapons such as towed antitank guns, tank-mounted howitzers and tank destroyer guns were too heavy and bulky to approach within effective range without detection. Rockets satisfied the mobility requirements but were lacking in range and accuracy. The problem was to devise an entirely new type of weapon.

A thorough study of the problem led to the conclusion that there were two major problems that had to be resolved in order to reduce the weight to the desired maximum limit. *First, if recoil could be eliminated, it would obviate the need for the recoil mechanism and the great weight of carriage necessary for recoil absorption and transportation. Second, if chamber pressures could be reduced while still maintaining muzzle velocity at the minimum commensurate with accuracy at the desired maximum effective range, much thinner chamber and tube walls could be used.* Let us look behind the scenes and see how this was accomplished.

Back in the dim, dark days of our schooling we learned that for every action there is an equal and opposite reaction, or to put this axiom in the form of a formula, $MV = M'V'$. Keeping this elementary law of physics in

mind, analyze the actions which take place in the conventional weapon when the propellant is ignited.

The conventional type gun consists essentially of a hollow tube sealed at one end. When the propellant burns, it becomes gaseous, expands, and creates high pressures against the chamber walls, breechblock, and base of the projectile. The projectile is driven to the front and the pressure on the breechblock drives the weapon to the rear. The product of the mass and velocity of the projectile and of the gasses moving to the front must be equal to the product of the mass and velocity of the recoilling parts. (For this discussion we will disregard the forward push given to the weapon by the action of the projectile against the rifling of the tube.) If some mass could be driven to the rear with sufficient velocity to exactly balance the recoil, the weapon itself would remain motionless.

Early attempts at development of recoilless weapons employed some solid substance for this purpose. For example, the non-recoil gun developed by Commander Davis of the U. S. Navy during the first world war simultaneously fired a mass of plaster of Paris and buckshot to the rear as the projectile was propelled to the front. This weapon was abandoned because of the obvious disadvantage of having an oversized shot gun fire to the rear every time a projectile was fired. Another early type of recoilless weapon utilizing this principle was a German weapon which fired an oversize shell casing to the rear. Recently developed recoilless weapons solve the problem by expelling a mass of the propellant gas to the rear. Openings are provided in the breech and so shaped that a sufficient quantity of gas moving at the necessary velocity escapes to the rear, thus exactly balancing the force of recoil. Because of the fact that most recoilless weapons have rifled tubes, it is necessary to cant these openings to counteract the torque induced by the action of the projectile against the lands.

The problem of reducing chamber presures is met in two ways. First, muzzle velocities are reduced to the minimum which provide accuracy at the desired maximum effective range. Second, a pre-engraved rotating band is affixed to

FIGURE 71.—Artist's conception of the "Davis Recoilless Gun."

the projectile. This eliminates the need for the high pressures which are normally required to engrave the rotating band. This reduced chamber pressure allows the use of very thin tube walls. For example, the tube wall of the 57-mm recoilless rifle is only one eighth of an inch thick at the chamber and one-sixteenth of an inch thick at the muzzle! (Tube wall of the 57-mm towed gun is approximately 2¼" thick at the chamber and 1¼" thick at the muzzle.)

Having briefly considered the principles underlying the development of the recoilless weapons, let us now turn to the more detailed characteristics, capabilities, and limitations of the two recoilless guns which are now members of the family of infantry weapons, the 57-mm recoilless rifle and the 75-mm recoilless rifle.

The smaller of these two weapons, the 57-mm rifle, is a light, portable, rifle company weapon weighing 44.4 pounds complete for shoulder firing. It may be fired from any position standard for the rifleman. For prone firing the shoulder rest can be quickly converted into a bipod which, in conjunction with the extendable handle or monopod, forms a stable mount with a low silhouette. If desired, the weapon may be mounted on any mount standard for the .30 cal. machine gun by attaching a pintle.

The 1200 foot per second muzzle velocity makes the weapon capable of firing a 2¾-pound projectile a maximum range of 4340 yards. There are several types of ammunition available for the weapon, including the high explosive round which has a bursting radius of 17 yards, the high explosive antitank round which, through use of a conical-shaped charge, is capable of penetrating 3 to 3½ inches of homogeneous armor plate at any range up to the maximum, the white phosphorous smoke round, the inert round, and the target practice round which contains a small spotting charge.

Sighting of the 57-mm is accomplished by use of either a three-power telescopic sight or by metallic leaf sights which are provided on the sight mounting bracket.

The larger of the two weapons, the 75-mm rifle, is included in the heavy weapons company TO/E. It has a total

weight with sighting equipment, but without tripod, of 113 pounds. While the heavy machine gun tripod is the present standard mount for the rifle, it may be fired from any ground or vehicular mount for the .30 cal. machine gun. Firing from the light machine gun tripod measurably reduces the weight and silhouette.

This weapon fires a 14 pound projectile at a muzzle velocity of 1000 feet per second which gives it a maximum range of 7450 yards. The types of ammunition for the 75-mm are the same as those for the 57 mm. The high explosive round has a bursting radius of 25 to 35 yards. The high explosive antitank round will penetrate 4 to 4½ inches of armor plate at any range.

Sighting is accomplished by means of a three-power telescopic direct fire sight or by an indirect fire panoramic sight.

These two weapons are not a cure-all for the problems of the infantry soldier. The back blast makes them very easy to locate after they have opened fire. They are still very heavy for hand carry and ammunition resupply is a difficult problem. However, the mobility, extreme accuracy, great hitting power and low silhouette make them particularly well-suited for filling the gap that existed in the fire power of the infantry battalion.

Questions are often asked about the performance of these weapons in the past war. Actually, they were produced too late for any extensive combat tests, but a few examples of their effectiveness may indicate future possibilities.

On Okinawa, one round from a 57-mm destroyed a machine gun nest, killing all occupants, at a range of 400 yards. At a range of one and a half miles, a 75-mm scored three hits out of seven rounds fired at a cave mouth measuring two feet by five feet. Both weapons proved very effective against all types of point targets in difficult terrain.

On the other side of the world, two rounds from a 75, fired by an outfit in the 17th Airborne Division, knocked out a German 88 and an AA gun concealed in a house. A hundred Nazis tumbled out to surrender.

In Essen, captured German officers were unable to understand how American artillery could be adjusted on buildings across the street from their own lines. In reality, what they mistook for artillery was the fire of 57-mm rifles located across the street.

Near Hamelkeln, one round from a 57-mm fired at a range of 450 yards knocked out and set fire to a MK-IV tank.

Near Wessel, three rounds were required to knock out two MK-IV tanks at ranges of 400 and 250 yards. At 850 yards, three rounds produced a direct hit on a self-propelled 88-mm gun and forced the surrender of the two crew members who were not killed.

What these weapons have actually done for the infantryman is to give him a light, portable, direct fire weapon which can be counted on to produce results where terrain or other considerations limit the use of conventional-type weapons.

CHAPTER 17

Subcaliber Tactical Training

1. THE PROBLEM.—Are you charged with the tactical training of an infantry unit under conditions where most of that training must be indoors, or at best confined to a limited outdoor area which must be used again and again? If so, this article should solve your problems for it permits realistics, practical training, emphasizing the vital and difficult element of *command control.*

Subcaliber tactical training, like its brother, subcaliber weapons firing, is valuable because it requires the employment of the same practical techniques demanded by the actual situation. The success of the method depends upon two factors:

a. Reproduction of selected terrain by simple methods on a scale large enough to permit each participant to indicate his actions by the use of an individual symbol which he moves to indicate his reaction to any given situation.

b. Realistic conduct of each problem achieved through rigid adherence by every participant to the communication means which would be available under actual conditions. Loose general discussion of action to be taken is not permitted. Specific orders are issued using voice, voice-radio, wire, or arm-and-hand signals as appropriate. Each participant involved responds to orders received by issuing appropriate instructions to his own unit, or where no intermediate order is required, by appropriate movement of his individual symbol.

2. MAKING THE GROUND MAP.—*a. The Terrain.*—First the area to be reproduced and the scale to be used are determined. Usually a portion of an available map will be

selected and the scale will depend upon the space available. The detail indicated on the map may be amplified at times by actual knowledge of the area, or merely by assuming the existence of additional logical details. In this case the decision is to reproduce an area of the Fort Benning Reservation to a scale of one foot = one hundred feet (RF = 1:100). (See Figure 72). Since the area is 2,000 yards on a side, a

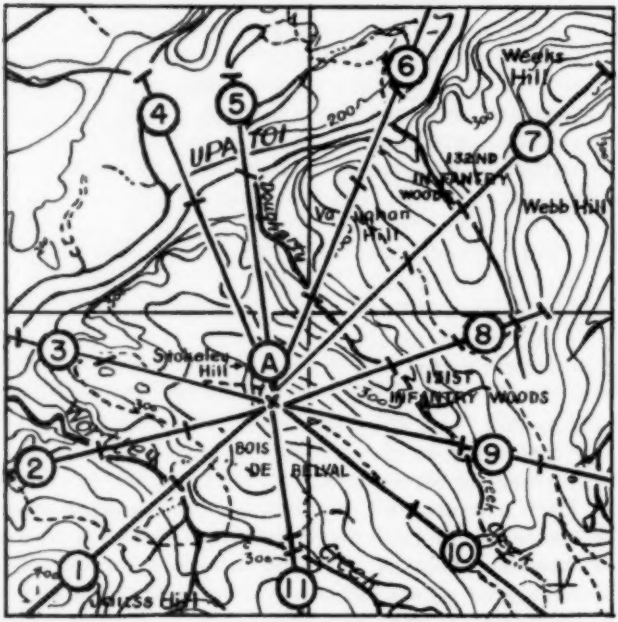


FIGURE 72.—Terrain map with key point (A) designatetd and azimuths laid off to recognizable terrain features.

space 60 feet on a side will be required for the ground map. Smaller areas are simpler to reproduce; larger scales can be used if space and the additional soil required to indicate relief are available.

b. The Control Sketch.—From the map, draw a control sketch of the area in question. Locate first the control point(s) upon which the ground map will be based. In this instance BM 391 (Stokeley Hill) is used. More than one control point can be used if considered desirable. Label BM 391 as Point A on the control sketch. (See figure 72.) Next plot lines on the map from A to each point which must be located accurately on the ground map. These points will be numbered in clockwise order beginning with Point 1 (Jauss Hill). Then, using a protractor graduated in mils (to facilitate later use of the aiming circle) secure and record the grid azimuth from A to each numbered point. For example A-1 measures 4040 mils. This azimuth can be converted to magnetic by correcting for the grid declination, however, grid azimuths can normally be considered as magnetic with satisfactory accuracy. The map distances from A to each point in turn are then measured in terms of ground distance. For example distance A-Jauss Hill scales 970 yards. Distances to important intermediate points on each line should be secured at the same time. Example, Wortley Creek on line A-1 scales as 400 yards. These scaled ground distances are converted to ground map distances to facilitate laying out the ground map. For instance, 970 yards is recorded as 29′1″ and 390 yards as 11′8″ on the ground map.

The scale used to plot the control sketch should be sufficiently large to permit legibility, 1:10,000 will usually suffice. Each azimuth and distance may be recorded directly upon its pertinent ray on the control sketch or a separate data sheet may be used. Pinpoint accuracy is unnecessary. The number of points located by measured angle and distance should be kept to a minimum since once an accurate skeleton of the area is laid out, intermediate points can be located by estimation with sufficient accuracy. (See fig. 73.)

c. The Ground Map.—As soon as the control sketch is completed, the ground map can be constructed. A couple of intelligent assistants, an aiming circle, a tape measure at least 50 feet in length and a number of small wooden pins numbered to correspond with the key points on the control sketch will do the job. Point A is suitably located on the

selected site of the ground map and the aiming circle setup and oriented over this point. The azimuth of each of the numbered points on the control sketch is then laid out on the ground. Initially, it is convenient to extend each line the

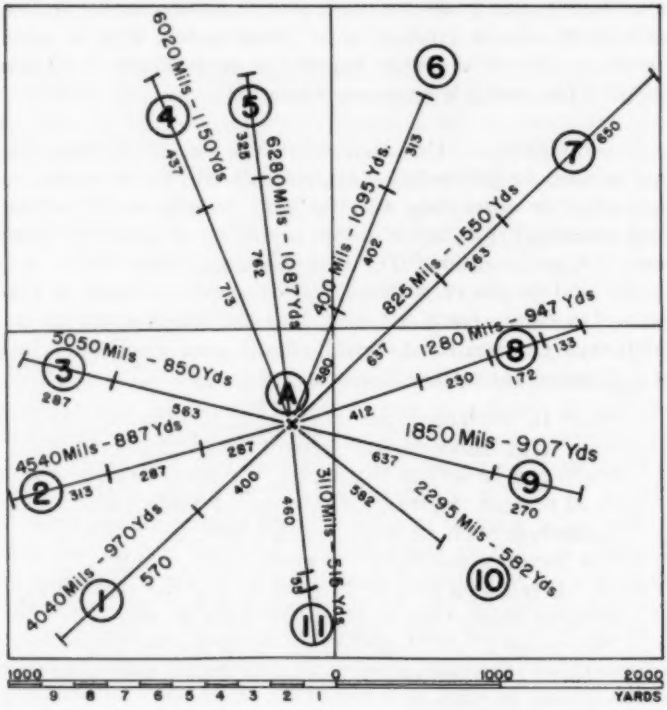


FIGURE 73.—Sketch made from terrain map showing azimuth and distance from key point (A) to predetermined terrain features.

same distance, for example, the full length of the tape used. Later, the proper distance can be measured on each line and the point located and marked. Once the frame work is laid

out, the terrain can be readily reproduced. While the horizontal control is accurate, relief is only shown with relative accuracy sufficient to be recognizable. Initially, a pile of dirt is dumped to mark each high point and then worked to shape and relative elevation. Improvised materials such as twigs can be used to represent wooded areas, roads are laid out with engineer tape or cloth stripes about an inch and a half wide. The amount of detail shown will depend upon the ingenuity of the workers, the time available, and the purpose for which the map is intended.

3. GENERAL CONSIDERATIONS.—*a.* In France the two assault battalions of a regiment went thru a rehearsal of a river crossing they were to make on such a map which was constructed in about three hours by a detail of three men. Objectives, identifying landmarks, azimuths of advance, and distances were all pointed out to the men, a platoon at a time. Each not only had the opportunity to see what was planned for his own platoon, but could see what was planned for adjacent units.

b. Skill in the construction of such a map is rapidly developed after three or four ground maps have been built. All details can be left in the hands of a competent noncommissioned officer. Furthermore, once the control sketch has been prepared, such an assistant can precede an instructor to a new location and have the ground map ready upon his arrival. A truck, a couple of men, and some shovels plus two or three hours time is all the equipment needed to prepare the ground. It is surprising how readily such areas can be identified and the refinements which will be added by interested assistants.

c. Bear in mind that while direction and distance are to scale, elevation is only relative. Small signs giving the names of terrain features are worth while. Even when actual names are lacking it is desirable to use identifying names, letters, or numbers to facilitate recognition and references. (See figure 74.)

d. Naturally, there is no objection to using the conventional cross section cord procedure setup for the construction of sand table terrain, however, the foregoing procedure is simpler for large scale ground maps.

4. TRAINING USES.—*a. A Training Aid.* The ground map can be used for any purpose for which a sand table would be suitable. However it has a far wider scope. Its wartime use in the rehearsal of an actual operation has already been mentioned. Its most important possibility, however, lies in its value as an aid to instruction in small unit tactics. Before taking part in an actual problem, students should be given approximately an hour's drill on scale and direction. Each is impressed with the fact that a foot on the ground map represents 100 feet on the ground, a distance it would take him twenty seconds to cover on roads by day and up to 2 or 3 minutes cross country at night. Direction is easy since the ground map is oriented to the cardinal points. Time factors for digging in, eating, and other routine actions are established. Each man is cautioned that his symbol represents himself, that he can say nothing he could not say under actual conditions and that if he is supposed to be firing, he will hold his right hand straight up in the air to so indicate. It will not be easy at first to limit discussion to actual orders or instructions. Every one will be prone to digress to a general academic discussion which naturally begs the issue of the real problem of actual combat which is *command control.*

b. Injecting realism.—It is desirable to have a reduced scale signal setup available. Match sticks or other simple devices can be used to represent the participants. It is not desirable to force the speed of an action, but rather to give men a true picture of how slowly actual combat moves and the actual time required for issuance of orders, reconnaissance and work. The unit will profit from such training if imagination is used and the problem is not permitted to degenerate into a discussion of what would be done. A small fine each time the control rules are broken is an effective means of increasing the participant's effort.

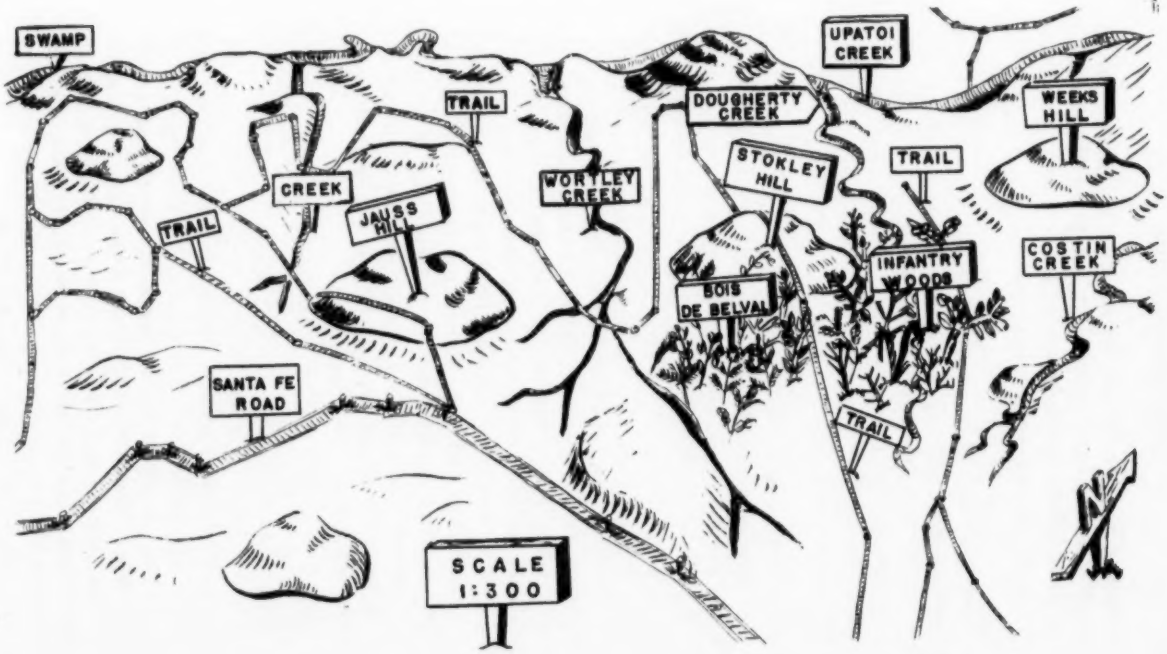


FIGURE 74.—Completed ground map with terrain features indicated by signs.

5. A TACTICAL EXERCISE.—The following offensive problem is based on Special Map No. 16, AEC, Fort Benning Reservation. (See figure 75.)

a. Situation.—At 1000 today our forces advancing NE astride UPATOI CREEK have been in action for 4 hours. Left boundary of the 1st Bn, left assault battalion of the 1st Inf, coincides with the regimental boundary along UPATOI CREEK (excl). The left flank company (Co A) has been assigned a frontage of approximately 800 yards. It has been assigned as successive objectives—JAUSS HILL, STOKELEY HILL and WEEKS HILL (all incl).

b. The situation as known at 1000 is as follows:

(1) On the left, NW of UPATOI CREEK, resistance has been heavy. The 3rd Inf has bogged down and its right flank is now 1500 yards west of JAUSS HILL (18.6-23.0). 3rd Bn, 1st Inf (regtl res) has established contact with 3rd Inf at this point.

(2) On the right (NE) the 2d Bn, 1st Inf has reached the line IVY ROAD—KELLY HILL and are in contact with B Co, at (22.0-23.0). Firing in that area is heavy. Last report from 2d Bn at 0930 indicated that they had encountered an organized defensive position to their front (NE).

(3) 1st Bn, 1st Inf has encountered no organized position, but on three occasions this morning ran into heavy small arms and mortar fire from isolated terrain features which were taken. Hostile artillery fire has been light and from long range.

(4) B Co on A Co's right holds the eastern edge of BOIS DE BELVAL and is heavily engaged with resistance on STOKELEY HILL and in 131ST INF WOODS.

c. Co A has just seized JAUSS HILL after a brisk fight and is now disposed as follows:

(1) 2d Platoon (8 casualties including the platoon leader and one squad leader) has just captured JAUSS HILL by assault from the west and is now reorganizing on the western slopes of JAUSS HILL with security covering the forward slope.

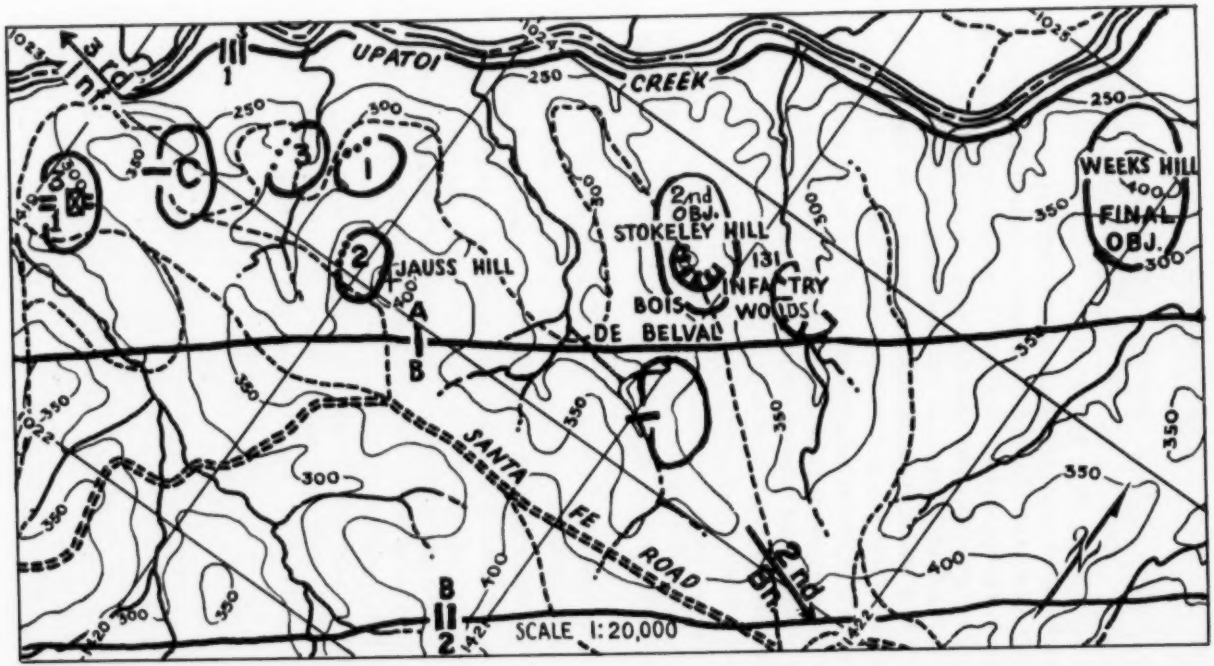


FIGURE 75.—Terrain map showing 1st Bn situation at beginning of exercise.

(2) 1st platoon (4 casualties) and weapons platoon (1 casualty) occupy firing positions along southern edge of woods, 150 yds N of JAUSS HILL. They effectively supported the 2d platoon's attack on JAUSS HILL.

(3) 3d platoon (company support) has halted 300 yards NW of 1st platoon (19.7-23.4). It is protecting the left flank of the battalion and has been advancing generally along the high ground on the east bank of the UPATOI. CO, Co A with CP group has just reached the 1st platoon position. Co C (bn res) is following in trace of the 3d platoon along the same general axis of advance. At 1005 firing in the A Co zone has ceased. At this time the following SCR 300 message was received from CO, 1st Bn:

"B Co held up along E edge BOIS DE BELVAL by automatic weapons and heavy mortar fire from 131 INF WOODS and STOKELEY HILL.

"A Co will push forward at once, develop situation to front with view of attacking STOKELEY HILL from W or N.

"C Co takes over protection of W flank, prepared to support A Co action."

6. CONDUCT OF TRAINING.—*a.* A map or chart outlining the tactical situation just described should be set up to amplify the ground map. Since this is the tactical setting which the participants would be actually "living," a period of time should be provided to insure that all are familiar with the developments up to 1000. Included in this briefing should be a drill on the scale of the ground map designed to insure that each participant clearly visualizes the ground distances involved. For example, that 1 inch on the ground map is equivalent to about 8 feet on the ground, that therefore a foxhole should be slightly less than an inch long, a squad column some 2 or 3 inches long while a range of 300 yards would be represented by 3 yards on the ground map.

b. Arrangements must be completed covering the details of the play of the problem at the level desired. For example, if the problem is to be on the company level, it will probably be desirable for personnel down to include squad leaders to be present. Symbols used could, therefore, represent an

entire squad. One complete squad might be present with their individual symbols to test the adequacy of orders issued, etc.

c. The communication system should be set up to operate, for example, in a company problem. CP's for company and platoon should be appropriately located in the space available with sufficient dispersion to permit functioning of radio and telephone if the latter is provided. A platoon setup should provide appropriate areas for personnel of each squad and for the CP.

d. Drill in the mechanics of operation should be included. For example, a squad leader after being allowed to place his squad in position at point A, could be given either an oral order or written message requiring the squad to move to B by a specified route. His orders to accomplish this would be tested by having each man move his symbol to comply with his understanding of the order issued. It requires considerable emphasis to get each man to participate fully and use his imagination. Once the participants get the idea, progress is rapid. However, it must be realized that the tactical handling of a squad or a platoon whether on the ground map or in battle is seriously handicapped without a prearranged battle drill. The details of such combat procedures are beyond the scope of this article, but it should be pointed out that lacking such mutually understood procedures, a battle leader can be compared to a quarterback forced to originate and explain his next play in the huddle. The stereotyped complaint that battle drill leads to stereotyped procedure and thus permits the enemy to anticipate our action, advocates, in effect, the maintenance of secrecy by the rather hazardous process of not knowing ourselves what we intend to do. Effective deception resulting in tactical surprise can well result from a variant of an established SOP which the enemy expects us to follow. For example, the firing of preparatory fires in phases with irregular intervals between so that the defender does not know which pause the assault will follow, or the establishment of a base of fire for a platoon attack by what appeared to be an envelopment, are two variants which frequently serve

to deceive the enemy as to the time and place of the attack. The stumbling of a unit which lacks such combat drill does not indicate that this training means is inadequate; the same squad would fare just as poorly on the actual ground.

7. RECONNAISSANCE AND ORDERS.—*a.* With all preliminaries complete, let us again consider the tactical problem. Captain Co A is confronted by the necessity for an immediate estimate of the situation, followed by action and orders.

b. While this is being played, it would be profitable to play the reorganization of one or more of the platoons. Inasmuch as the 1st platoon is still in firing position facing SE and must reorganize for further advance to the NE, its reorganization presents an interesting routine problem. With each participant aware of the location of his own symbol, oral orders or signals by the platoon and squad leaders should be followed by appropriate movement of individual symbols. It is true that the slower thinkers will tend to imitate the actions of the more alert men, but this condition will also be true in combat. Consequently, a valuable opportunity is presented to study individual reactions and attitudes. The instructor conducting this phase will, as in a field problem, observe closely to obtain essential material for his critique. It is surprising the number of details which must be attended to even in this very simple problem. Measures should be taken to include security, reorganization required by the four casualties, handling of these casualties, ammunition replenishment, and preparation for continued action. Reconnaissance by the platoon leader of his front and flanks, lateral contact and prompt report of completion of the reorganization to company headquarters are also required. It is estimated 30 minutes will be required to complete reorganization and perhaps 10 minutes for the critique.

c. Meanwhile the company commander should have completed his estimate and essential reconnaissance and be prepared to issue orders initiating renewal of the advance or assumption of the defense. His problems however have been

many and none too simple. The instructor controlling this will be observing among other factors:

(1) Command reconnaissance to include use of map, ground, subordinates, and routes taken, time required, etc.

(2) Time and space factors and formation selected. The problem of regrouping to continue the advance is closely tied in with the formation to be used. Obviously, the 2d Platoon should be withdrawn into support. Since the 3d Platoon has been released by battalion from left flank security, either or both the remaining platoons could be used in assault. A formation of column of platoons echeloned is considered preferable, however either inverted wedge or wedge would be acceptable.

(3) Reports and orders constitute a problem. Decision must be made as to where and when the company order will be issued. This will depend on reconnaissance and inspections by the company commander, both further complicated by time and space factors and communications available. An acceptable solution would be for Captain, Co A, together with Platoon Leader, 2d Platoon, and selected assistants to move to the 1st Platoon position to issue the order. Platoon Leader 3d Platoon could be directed by SCR 536 to report to this position. A written message could be sent to him or the company commander could continue on to the 3d Platoon position and issue fragmentary orders.

(4) Control and contact measures included in the order should provide for security, intermediate objectives, axis of advance, boundaries, frontage, base unit, and/or other means of lateral coordination with B Co and within A Co itself. Arrangements for displacement of rearward platoons automatically, or on order, will be required. Command echelon location, communication plan and method of maintaining lateral contact must be covered either in the order, or as a matter of SOP. A careful check on time and space is essential to preserve reality. Where oral orders are issued, they should be received only by those who would actually be within hearing distance of such orders. Use of written messages, radio, or phone should be actual and delivery based on time involved. It is believed that A Co should be moving

out by 1100 which allows practically an hour for reorganization, visual reconnaissance and orders. The tendency to adopt unreal time factors must be resisted and standards recognized which exploit teamwork and training and yet allow for necessary action. Too often in battle, lack of familiarity with what was required caused undue delay or placed harassed battle leaders under unwarranted pressure for faster action.

The detailed tactical decisions discussed will be largely controlled by the greater terrain details shown by the ground map which will permit more information to be obtained by reconnaisance. Actually the woods indicated in this area are second growth spruce with scrub oak and pine brush permitting visibility of about 65 yards. All trails are passable for ¼-tons. WORTLEY CREEK presents some obstacle to foot troops particularly during the 500 yards before it empties into the UPATOI by reason of steep banks covered with heavy growth. The instructor acting as CO 1st Bn, can control action logically and call attention to flaws or omissions in the company order.

d. Once the company order has been issued, play should be limited to a platoon at a time. It may be that play of one of the assault platoons problems will be considered sufficient. As an example, let us consider onlv the action of the 1st Platoon as the assault platoon in a formation of echeloned platoon columns. Under these conditions all or any of the 2d and 3d Platoons present should be grouped where they can observe with minimum interference. To avoid the casual "spectator complex," check lists could be furnished which would permit spectators to follow the action in a critical style, anticipating required action. Such spectators should understand that some of them will be called upon later for short critique of a particular phase and that all should keep running notes accordingly. It is desirable to have a separate instructor handle the spectator group.

8. PLATOON ACTION.—*a.* The action of the assault (1st) platoon should constitute the major part of this problem. Within the limitations of the company order, the platoon leader must issue instructions controlling his *security,*

command, combat and *support* echelons; provide for lateral contact to the SE (unless taken care in company order); and include adequate control measures as to direction, intermediate objectives, frontage, conduct of the advance, etc.

b. Without an adequate battle drill or SOP, control presents a complicated problem. For example, if the decision is to use two pair of squad scouts as the security ecehlon, the platoon leader, left without a commander for his security echelon, is faced with the problem of controlling two separate reconnaissance elements. However, his problem would be comparatively simple if his platoon had been trained to follow a procedure such as this:

(1) The reconnaissance elements of the platoon, unless otherwise specified, will be formed by the scouts of two indicated squads operating as a patrol under command of a designated noncommissioned officer.

(2) Their advance will habitually be conducted by bounds from key point to key point. (The characteristics of a key point should be carefully covered.)

(3) Upon reaching a new key point, the following procedure will govern: right pair observes right front and right flank; left pair, left front and flank; leader entire area. The leader's first decision is to select the next key point to which the security echelon will move. His next is to decide whether the situation is sufficiently routine to permit further advance before the command echelon reaches him. In the event he decides this is the case, he informs the platoon leader of this decision by prearranged signal. In event the platoon leader accepts this plan, the command echelon signals back "ALL CORRECT." If the platoon leader desires contact with his security echelon the signal "HALT" is passed back to the security element. Under such conditions "security" prepares to receive and brief the platoon leader to best advantage. One scout from each pair takes a position near the patrol leader leaving a 5 to 10 pace interval. Into this interval the platoon leader moves his command group taking cover nearby.

c. Before moving forward from a key point the unit is trained to consider the situation as to its effect upon formations with the three following patterns in mind:

(1) Contact unlikely, distance to next key point over 500 yards. Here the rate of advance is obviously a walk and a patrol formation affording depth as well as width is desirable to afford a deeper cushion of space before the command echelon must follow.

(2) Contact likely, average distance to key point 300-500 yards, gait still at a walk, formation either pairs or diamond.

(3) Contact likely, distance to next key point short (point blank range)—here the advance if continued, should be by short bounds of single men covered by others. The alternate method of "reconnaissance by fire" should be considered before a bound is made. It is the exceptional enemy who has been trained to the point that he will withhold fire when a few well placed shots are fired at his position. Frequently he will reply thinking his position has been discovered. Even when he realizes the purpose of the fire, his only alternative is to withhold fire as he should have done in the beginning.

d. Careful decision should be required of the security echelon as to whether further advance is warranted. The scout realizes the danger of further movement at point blank range. When the situation is particularly difficult, such advance should be supported by a base of fire of at least a squad and preferably two. In a favorable firing position the comamnd and combat echelons may frequently merge temporarily with the security echelon. This encourages the security patrol, affords opportunity for bringing everyone up to date and costs less time than will be lost if the security echelon goes astray or is pinned down without fire support. Similarly, the advance of the support echelon can be controlled by an SOP such as the following: Unless otherwise ordered, the support echelon will occupy position one bound behind the assault, unless this key point is more than 400 yards behind assault. In such instances support will occupy intermediate cover short of the assault

echelon position. Lacking this, the support echelon will temporarily merge with the assualt to utilize the same position, picking up its distance when the assault echelon moves forward. Every phase of combat can be advantageously governed by a series of such procedures. These procedures are developed in the bitter school of experience anyway. Variants can be developed and other action ordered as desired, but a general pattern of action is laid out. Try leading a platoon which has no operating routines.

9. SUMMARY.—It is realized you will have difficulties with this method of training. These difficulties can be classified into two groups:

a. The artificial difficulties imposed by the use of reduced distances and symbols. These will be reduced by practice and the cooperation of the participants. Offsetting these disadvantages is the fact that the reduced scale permits a bird's-eye view and consequently a greatly improved perspective. For example, every participant, be he platoon leader or rifleman, will have a better overall picture of the situation than he would under actual conditions. Leaders can see weaknesses they might miss in the field.

b. The second group includes those difficulties which would exist even if the problem were conducted at full distance. Some of these cannot be eliminated since they deal with the realities of battle such as the effect of hostile fire. Other difficulties such as control or communication can be eliminated by this training. Problems can be set up covering the defense as well as the attack. For example this problem could be replayed to require the hasty consolidation of JUASS HILL against impending counterattack. Finally, like any other training aid, you will get out of this method only what you put into it. It is only a means and must be operated with skill and imagination.

CHAPTER 18

Supply of the Rifle Company and the Battalion in the Defense

OPERATIONS

The following terrain exercise is used at The Infantry School for instruction of Officer Candidate Classes in combat supply. This problem can readily be adapted to instruction of noncommissioned officers and company grade officers or be utilized by ROTC and National Guard instructors with minor variations.

It must be kept in mind that many students will have had no previous instruction or experience to guide them in arriving at a solution to this problem; neither are they fully familiar with the personnel and transportation available within the regiment for supply operations. In order to overcome this handicap and to orient the student on supply procedures within the regiment as a whole, the first hour is spent as an introductory and orientation period. Three charts as explained below are used to assist in this instruction.

Using figure 76, the instructor points out where the supply personnel and transportation are assigned. He covers fully the duties and responsibilities of the personnel stressing their relationship to the company and platoon commanders. Use of transportation is covered here and also in the next two charts. Since the students are prospective officers, the instruction is aimed at platoon leader level showing where he fits into the picture and to whom he looks for his supplies.

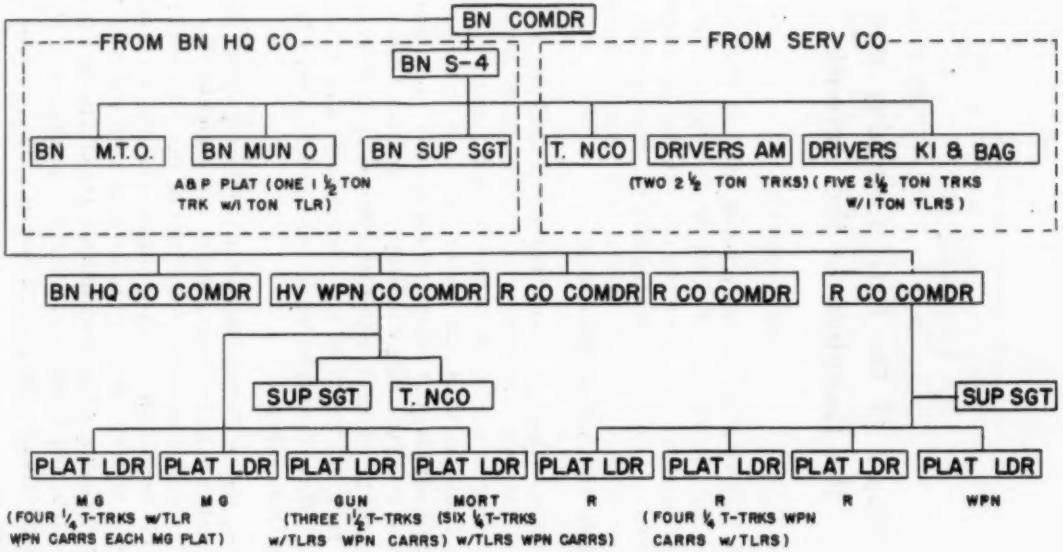


FIGURE 76.—Supply Organization—Infantry Battalion.

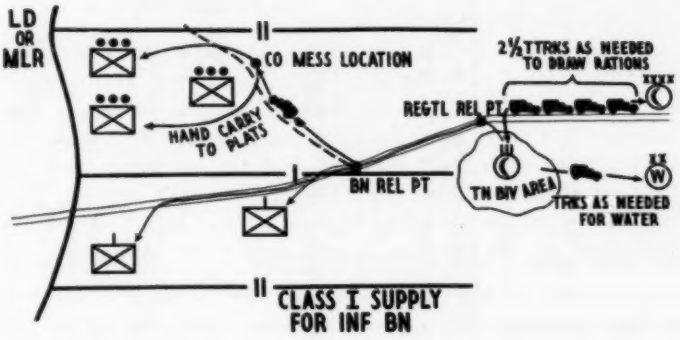

LD OR MLR
CO MESS LOCATION
2½ TTRKS AS NEEDED TO DRAW RATIONS
REGTL REL PT
HAND CARRY TO PLATS
BN REL PT
TN BIV AREA
TRKS AS NEEDED FOR WATER
CLASS I SUPPLY FOR INF BN

FIGURE 77.

Using figure 77, instructor is able to follow through on the distribution of rations from the Army Class I supply point to the regimental train bivouac area where the break-

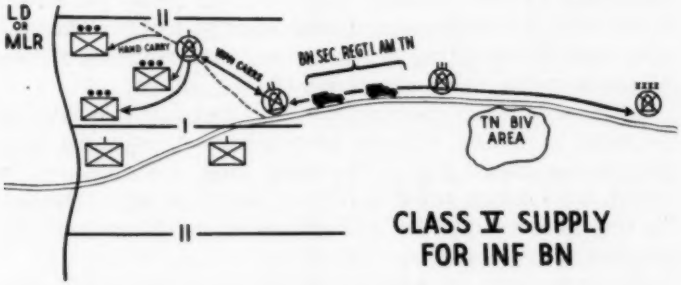


FIGURE 78.

down occurs. Thence distribution forward to company mess location (via regimental and battalion release points) on the kithchen and baggage vehicles. Again, because the students are prospective platoon leaders, the greatest stress

is placed on the hand-carry method of transport from the company mess location to the platoon feeding area where the men are fed in small groups.

Using figure 78, the instructor discusses the procedure of ammunition distribution from the Army ammunition supply points (ASP) as far forward as platoon level. The ammunition is actually handled, and the method used for ammunition is actually handed, and the methods used for transportation of the ammunition at each stage. The station of the division ammunition officer is not shown on the chart but his function is explained in the discussion.

THE PROBLEM

The problem is a terrain exercise where students are actually placed on the ground. (See fig. 79). Students are located originally in the area of the support platoon, overlooking the areas of the other two rifle platoons. Since it is believed that young officers will often be required to operate from sketches without the use of detailed maps, no map other than the sketch shown is used. Students are required to orient themselves on the sketch prior to the beginning of the problem. Instructional matter is issued to the students on mimeographed sheets which are divided into sections consisting of a situation, requirement, solution to requirement, and a discussion of the solution.

In the solution of the requirements, the student is allowed as much individual thought as possible. Any logical solution is acceptable but at the same time, all instances in which the solution could have been improved are discussed. In this manner interest and initiative on the part of the student are encouraged.

Extracts from the exercise as issued to the class in sections are presented below. The sketch is issued with the first section at the beginning of the problem.

SUPPLY OF THE RIFLE COMPANY AND BATTALION IN DEFENSE

Section I

1. SITUATION. *a. General.* (1) *References.* FM 7-10; FM 7-20; FM 7-30; T/O & E 7-17 (15 June 45).

(2) *Purpose.* The purpose of this exercise is to illustrate some of the responsibilities of the company commander, battalion S-4 and platoon leader in connection with the supply of their units and the operation of the battalion supply system in a defensive situation while in direct contact with the enemy.

(3) *Map.* See sketch 1:200,000. (Figure 79.)

b. The 1st Battalion, 1st Infantry, part of a larger force, crossed the CHATTAHOOCHEE RIVER, 12 December and attacked northeast. By 1600, the enemy had been driven east of OCHILLE CREEK. The division commander, on receipt of information that the hostile force is being heavily reinforced, decided to assume the defensive and to organize and defend his position with the main line of resistance and the boundaries between regiments as shown on the attached sketch.

c. At 1730, the 1st Battalion received orders for the defense of the right (south) battalion defense area in the regimental sector. The battalion commander plans to organize his area with rifle companies disposed generally as indicated on the accompanying sketch; the heavy weapons company to support the defense from selected positions in the battalion area.

d. At this time, battalion S-4 is familiar with the tactical situation and is in possession of the following administrative information:

(1) The 1st Battalion ammunition supply point is located near the junction of 1st Division and the old 1st Division Road. (See sketch.)

(2) The battalion ammunition train, loaded with all types of ammunition is under battalion control at the battalion ammunition supply point. All company transportation is under company or platoon control.

(3) Status of ammunition within the battalion:—Reports from companies indicate that there is sufficient ammunition to last until after dark.

(4) The battalion set of infantry intrenching equipment, carried on the ammunition and pioneer platoon truck and trailer, is to be issued as soon as practicable:

1/3 to each rifle company, the rifle company in turn to make available a proportionate amount of the equipment to elements of the heavy weapons company in its area.

(5) Field fortification materials will be released to battalion at battalion ammunition supply point at 1930.

FIGURE 79.—Sketch Map.

(6) Kitchen trucks of the battalion section of the regimental kitchen and baggage train with hot supper, water and individual rolls will be ready to move forward from battalion kitchen area (time-distance, 20 min from battalion ammunition point) at 1915. Trucks to revert back

to battalion kitchen area at 2215. Food for the 1st Platoon Company D will be on Company B kitchen truck.

(7) The regimental commander has directed that: (a) The present ammunition loads of weapon carriers and ammunition train trucks be placed on position.

(b) One (1) additional unit of fire for all weapons be placed on position.

(c) Vehicles not required for the defense of the position revert to regimental control.

(8) The use of lights is prohibited.

(9) Darkness begins at 1905. Daylight at 0810.

(NOTE: One set of infantry intrenching equipment weighs approximately 3,000 lbs and contains among the larger items:

26 axes
26 cross-cut saws
500 sandbags (empty)
125 pick-mattocks
250 shovels

2. FIRST REQUIREMENT. As battalion S-4 state your plan with respect to the following:

a. Ammunition now on the battalion ammunition train.

b. Disposition of the battalion ammunition train trucks (after the additional ammunition has been placed on position) and of the emptied weapon carriers.

c. Time and method of distribution of the battalion set of infantry intrenching equipment.

d. The feeding of the battalion.

Section II

3. A SOLUTION OF FIRST REQUIREMENT. *a.* Dump the loads now carried on the battalion ammunition train at the battalion ammunition supply point and send all of the ammunition trucks to the rear for resupply. Dump the loads on the weapon carriers at the company ammunition supply points and send the vehicles back to the battalion ammunition supply point to move extra ammunition forward to the company supply points.

b. The weapon carriers and the battalion ammunition trucks would be sent back to the regimental train bivouac, or defiladed in rear of the battalion defensive sector. If possible, battalion to exercise direct control over these vehicles under the battalion motor transportation officer. Vehicles dispersed in an area close to the battalion defensive position. Such an arrangement is equally as good, but will require communication between the command post and the motor pool. In this instance the regimental train bivouac is only a short distance and due to the fact that battalion transportation and battalion ammunition trucks must be refilled during early morning with their prescribed loads of ammunition in order to provide a mobile reserve of ammunition for the regiment, it is best to bring them back to regimental control. Later, as the situation develops, all transportation should be brought back to battalion control. This procedure will enable regiment or battalion to:

(1) Furnish an emergency supply of ammunition in case it is needed.

(2) Be able to support quickly any change in the tactical plan.

c. Have the battalion supply sergeant or a member of the battalion ammunition and pioneer platoon conduct the 1½-ton truck and 1-ton trailer of the platoon, shortly after dark, to Companies B, A, and C, in turn, delivering approximately one-third of the equipment contained in the infantry intrenching set to each at their company ammunition supply points.

d. (1) Select a battalion point of release for kitchen and baggage vehicle at the junction of 1st Division-Old 1st Division Road.

(2) Inform company commanders that kitchen trucks with supper, and individual rolls will be released at the battalion point of release at 1935. Trucks to revert to battalion control at the battalion point of release by 2155.

(3) Send a representative to battalion kitchen area at the prescribed time to meet and conduct the vehicles to the battalion point of release. Have the representative meet

the returning trucks at the battalion point of release and conduct them back to the battalion kitchen area by the prescribed time.

4. DISCUSSION-SOLUTION OF FIRST REQUIREMENT. *a.* In order to start dumping the unit of fire on positions as soon as possible, the loads of the battalion ammunition train trucks are dumped and the trucks sent to the rear for resupply. In the attack the weapon carriers have been used for ammunition supply, therefore, they can be used to bring up this first load of ammunition for the defense from the battalion ammunition supply point to company ammunition supply points.

b. Flexibility and mobility in supply operations are promoted by disposing supplies in depth and by keeping supply vehicles loaded to the maximum extent possible. Weapon carriers are not filled to capacity due to the possibility of being used to displace weapons and/or personnel should the tactical situation warrant. It must be kept in mind that in many instances the terrain is such that vehicles larger than 1/4-ton cannot operate down to the battalion or even in the regimental sector. Consequently, it is necessary to redistribute the company transportation to provide ration jeeps to take care of all classes of supply in the battalion. For example:

(1) In the mountains and the jungles the larger vehicles cannot negotiate the trails to the vicinity of the troops on line.

(2) In the pursuit of an enemy all transportation including supply vehicles are needed to transport troops over long distances. It is then necessary to dump kitchens and other bulk in an infantry regiment on the ground and use kitchen trucks to transport troops. All feeding becomes C or K or D rations. (However the six 2½-ton ammunition train trucks and the Cannon and Antitank Company ammunition trucks must be kept free to haul ammunition.)

(3) In amphibious operations it is often necessary to make the initial landing with reduced transportation; both

company transportation and cargo vehicles must be reallocated.

c. Battalion S-4 has his representative distribute the intrenching equipment equally to the three rifle companies shortly after dark. Each rifle company should make available to the elements of the heavy weapon company in its area a proportionate share of the infantry intrenching equipment. The representative of the battalion S-4 in this instance would be the ammunition and pioneer platoon leader.

d. The battalion feeding plan does not prescribe the detailed manner in which companies will handle feeding, but only the time and place at which kitchen trucks will be released to companies and revert to battalion control. No terrain is such that all rifle companies can adopt the same menner of feeding or the same type of rations. Where practicable the hot meal is the rule. In the jungles, feeding is done during daylight. In the mountains, supply vehicles move both during the day and night depending on enemy observation. In fast moving situations, troops are fed whenever supply vehicles can catch up. Difficulty in supply begins at the battalion installations and continues down to the troops. It is comparatively easy to maintain sufficient supplies of all classes within regiment, however, getting needed supplies to troops in line may require use of tractors, planes, jeeps, mules and porters—one or all of these expedients for one rifle company. The manner in which food is brought forward to each man in a rifle company is a responsibility of the company commender. In situations like the one described in this problem, it is found that kitchen trucks can more easily be released to battalions or companies at the regimental train bivouac or at the point where food is prepared. It is essential that all officers having responsibilities in the feeding plan cooperate and meet the time schedule prescribed.

5. SITUATION CONTINUED. *a.* At 1800, the battalion commander's orders for the defense of the battalion area and the battalion feeding plan were delivered to Captain

Company B by a messenger. By 1830, Captain Company B had completed his reconnaissance and issued his order. He disposed the rifle platoons as indicated on the sketch. He attached one 60-mm mortar to each front-line platoon and held one under company control.

b. In his order the battalion commander directed that the light machine gun section of Company B, and the 1st Platoon Company D (MG) be emplaced as shown on the sketch.

c. Captain Company B has considered administrative as well as tactical details in formulating his plan for the defense of the company area.

d. Lieutenant Weapon Platoon Company B has reported an unserviceable light machine gun in the 2d Platoon area. The weapon has a damaged receiver necessitating repair beyond the means available within the regiment.

e. For the Company B ammunition supply point location, see sketch.

f. Company B mess location is at a point in the woods near the company ammunition supply point separated from that installation by about 90 yards.

6. SECOND REQUIREMENT. As Captain Company B state your plan with respect to the following:

a. Distribution of ammunition to platoons.

b. Distribution of the 1/3 set of infantry intrenching equipment to platoons.

c. Company feeding plan to include the 1st Platoon Company D.

Section III

7. A SOLUTION OF SECOND REQUIREMENT. *a.* Notify platoon leaders that distribution of ammunition to platoons, after battalion has dumped ammunition at the company ammunition supply point, is to be effected by platoon carrying parties, starting shortly after dark.

b. Notify rifle platoon leaders and the machine gun platoon leader as to the time, and in what quantities, tools

will be available and that distribution is to be effected by platoon carrying parties. Have the tools placed in 5 piles at the company ammunition supply point.

c. Instruct the platoon leader of the weapon platoon to send the unserviceable light machine gun back to the battalion ammunition supply point, through the company ammunition supply point, on the first vehicle going to the rear for ammunition with a request for repair or replacement. (Battalion S-4 sends it to the Division Ordnance Maintenance Company through the regimental ammunition supply point, on the first vehicle going to the Army ammunition supply point, with a note requesting immediate repair or replacement of the weapon.)

d. Company B personnel to be fed as follows: (1) Men in the area of the 3d Platoon, company headquarters, and any others in the immediate area, to eat at the company mess location.

(2) Members of Company B in the areas of the 1st and 2d Platoons to be fed by platoon carrying parties.

e. Captain Company B notifies the Lieutenant 1st Platoon Company D of the site of Company B's mess location, the time at which supper will be available, and the time by which empty containers must be returned to the company mess location.

8. OTHER SITUATIONS, REQUIREMENTS AND SOLUTIONS.—In the problem as conducted at The Infantry School, other situation, requirements and solutions are included. The problem can be extended to require participants to:

a. Make a reconnaissance to determine the best routes for day and night carrying parties.

b. Compute the weight of food, water, ammunition, and engineer supplies to be moved forward and the size of the carrying party required to accomplish the task.

9. SUMMARY. *a.* This terrain exercise, has covered the supply operations that normally take place within an infantry battalion in a defensive situation including the

movement of supplies from the rear of the battalion area up to the platoon positions. Since this instruction is aimed at company grade officers, the decisions and actions of the company commanders and platoon leaders have been emphasized to show how, under normal or abnormal circumstances, these supplies must and can be brought forward.

b. In a defensive position, the preponderance of the dead weight of supplies that must be moved into the company and platoon area consists of food, water, ammunition, and fortification materials. Down to and including the company rear area, these supplies can often be moved on the normally assigned vehicles. But to accomplish the actual distribution within the company, any and all available means for moving these supplies must be used. The company commander and platoon leaders are the ones who will have to consider these various means and supervise the execution of plans to insure that every individual receives the essentials for combat at the proper time, at the proper place, and in sufficient quantity.